

## KOGRUKLUK RIVER WEIR SALMON STUDIES, 2002



By

Kevin J. Clark

and

Douglas B. Molyneaux

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## AUTHORS

Kevin J. Clark is a Fishery Biologist for the Alaska Department of Fish and Game, Division of Commercial Fisheries, 333 Raspberry Road, Anchorage, AK 99518-1599; e-mail, [kevin\\_clark@fishgame.state.ak.us](mailto:kevin_clark@fishgame.state.ak.us).

Douglas B. Molyneaux is the Kuskokwim Area Research Biologist for the Alaska Department of Fish and Game, Division of Commercial Fisheries, 333 Raspberry Road, Anchorage, AK 99518-1599; e-mail, [doug\\_molyneaux@fishgame.state.ak.us](mailto:doug_molyneaux@fishgame.state.ak.us).

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## ABSTRACT

The Holitna River is a major sub-basin of the Kuskokwim River drainage and is perhaps the largest salmon-producing tributary of the drainage. In 1976, the Alaska Department of Fish and Game established a weir on the Kogrukluuk River, the main branch of the Holitna River. The weir site is located approximately 750 km from the mouth of the Kuskokwim River. In 2002, the weir was operational from 26 June to 24 September. Estimated total annual chinook salmon escapement of 10,104 fish, was above the established sustainable escapement goal (SEG) of 10,000 fish. Total annual chum salmon escapement of 51,570 fish was above the established SEG of 30,000 fish. Total annual sockeye salmon escapement of 4,050 fish was below the recent 10-year average of about 9,000 fish. Total annual coho salmon escapement of 14,517 fish was below the established SEG of 25,000 fish. The age, sex and length (ASL) composition of the total annual chinook, chum and coho salmon escapements were estimated and carcass washout rate and timing by species was monitored. Variability in stream hydrological and meteorological conditions was recorded for potential environmental effects on salmon production and timing. The crew collected information in association with three mark-and-recapture projects, one operated on the lower Holitna River and two projects conducted on the mainstem Kuskokwim Rivers.

**KEY WORDS:** Holitna River, Kuskokwim River, weir, chinook salmon, sockeye salmon, chum salmon, coho salmon, recapture

## INTRODUCTION

Holitna River sub-basin is possibly the largest salmon-producing tributary of the Kuskokwim River drainage. Salmon escapements in the Holitna River have been documented since 1961 (Schneiderhan 1983, Burkey 1994), when the first aerial survey was conducted. Importance of the Holitna River as a salmon producer and the necessity to closely monitor salmon escapement motivated the Alaska Department of Fish and Game (ADF&G) to establish a weir on the Kogrukuk River, a tributary of the Holitna River, in 1976 (Baxter 1976; Figure 1).

Salmon spawning populations are dispersed throughout the Kuskokwim River drainage and escapement monitoring is limited to a few tributary streams, including the Kogrukuk River. Kogrukuk River salmon escapements are a relatively small percentage of overall salmon escapements in the Kuskokwim River drainage; however, this tributary appears to support an above average number of spawning chinook salmon *Oncorhynchus tshawytscha*, chum salmon *O. keta*, sockeye salmon *O. nerka*, and coho salmon *O. kisutch* when compared to other Kuskokwim River tributaries of like size (Burkey et al. 1999). Small numbers of pink salmon *O. gorbuscha* also spawn here.

Uniquely, the Kogrukuk River weir is currently the only site in the drainage with a history of enumerating sockeye salmon. Large basin lakes, typical sockeye salmon rearing habitat, are absent from the Kogrukuk River drainage, although some small headwater lakes have an unknown capacity for sockeye salmon production. Sockeye salmon have been observed spawning in the mainstem, in backwaters and sloughs. Sockeye salmon have been documented in several tributaries in the Kuskokwim River basin (Burkey and Salomone 1999) but little is known about these populations. Rearing ecology of these “river-type” sockeye salmon is unknown. They have apparently adapted to a lotic environment. The contribution of these river-type sockeye salmon to the overall Kuskokwim drainage sockeye salmon production should not be overlooked. Wood et al. (1987) found river-type sockeye contributed from 39% to 48% of the total sockeye salmon returns to the Stikine River in 1984 and 1985.

Total annual escapement for pink salmon in the Kogrukuk River is unknown because pink salmon are able to swim between the weir pickets, but the annual numbers observed are usually very low (less than 20). Considering the Kogrukuk River weir is approximately 750 km from the mouth of the Kuskokwim River, these pink salmon are among the furthest –inland-spawning pink salmon in the world (Morrow 1980, Groot and Margolis 1991).

Subsistence and commercial fishers who live along the Kuskokwim River place major cultural and economic importance on harvests of salmon. The lower Kuskokwim River supports commercial fisheries that occur in two non-contiguous districts stretching from the river mouth to Chuathbaluk, and the average annual commercial harvest for the past 10 years is 18,081 chinook salmon, 216,406 chum salmon and 453,755 coho salmon (Burkey et al. 2002). Commercial fishing has been an important component of the market economy of lower Kuskokwim River communities (Buklis 1999; Burkey et al. 2002). Downstream of the Holitna River, in the

mainstem Kuskokwim River, the average annual subsistence harvest of local residents swells to 78,564 chinook, 51,417 chum and 29,450 coho salmon (Burkey et al. 2002).

In the early 1980s, commercial fisheries management began to shift from a strategy emphasizing guideline-harvest-levels to a strategy emphasizing abundance. ADF&G established species-specific escapement objectives for streams that had sufficient historical information (Buklis 1993), which were later termed biological escapement goals (BEGs) and more recently sustainable escapement goals (SEGs). These goals represent simple averages, or medians, of historical information. The underlying principle in establishing escapement goals was, maintaining an average or above average spawning escapement should provide for sustained yield consistent with historical levels. Although commercial fishery harvests usually occur before escapements can be fully assessed, postseason escapement assessments are useful for evaluating the effectiveness of fishery management plans and inseason management decisions.

In 1983, escapement goals for Kogruklu River weir were established for chinook (10,000), chum (20,000), sockeye (2,000), and coho salmon (20,000). In 1984, escapement goals were increased to 30,000 for chum and 25,000 for coho salmon. Kogruklu River weir is the only project in the Kuskokwim River drainage with an escapement goal for coho salmon.

In the winter of 2000, the escapement goal policy underwent the latest in a series of reviews that resulted in reclassification of escapement goal definitions. At that time, established goals at the Kogruklu River weir were redefined as SEGs. According to the Policy for the Management of Sustainable Salmon Fisheries (Alaska Administrative Code section 5AAC. 39.222.), an SEG is a level of escapement, indicated by an index or an escapement estimate known to provide for sustained yields over a 5 to 10 year period and is used in situations where a lack of stock specific catch estimates prohibits establishing a more formal BEG. An SEG is supposed to be expressed as a range, and the department is charged to seek to maintain escapements within bounds of the SEG. No ranges have yet been established for the Kogruklu River project and existing SEGs are considered minimum escapement levels.

### *Objectives*

1. Determine the daily and total annual spawning escapement of chinook, chum, sockeye and coho salmon to the Kogruklu River.
2. Estimate the age, sex and length (ASL) composition of the total annual chinook, chum and coho salmon escapements such that simultaneous 95% interval estimates of the age composition will have a maximum width of 0.20.
3. Recover tag numbers and associated information from chum and coho salmon passing the Kogruklu River weir in support of the mark/recapture study conducted on the mainstem Kuskokwim River.

4. Serve as a monitoring site for chinook salmon equipped with radio transmitters deployed as part of a radio telemetry study conducted on the mainstem Holitna and Kuskokwim Rivers.
5. Monitor the carcass washout rate and timing by species.
6. Monitor variability in stream hydrological and meteorological conditions to provide information relating to potential environmental effects on salmon production and timing.

### *Background*

Kogruklu River weir was first installed at its current location in 1976 and has the longest operational history of any ground-based salmon escapement monitoring project in the Kuskokwim Area. The archive of historical reports for the project includes listing under the names Holitna and Ignatti weir, but ~~these~~ are the same project as described herein as the Kogruklu River weir. Before the weir, salmon escapement was enumerated in the Kogruklu River by means of a counting tower operated from 1969 to 1978. This tower was originally located about 2 km upstream of the confluence of Shotgun Creek, later relocated because of annual changes in the river channel, but the various locations were always upstream of the Shotgun Creek confluence. Initial installation of a weir was attempted in 1971, but was destroyed by high water early in the season. Both tower and weir operations in this section of the Kogruklu River have been hindered by log jams and shifting channels. Presence of a suitable weir site below the confluence of Shotgun Creek resulted in replacement of the tower by a weir beginning in 1976. Because the weir was located below the confluence of Shotgun Creek, both tower and ~~weir~~ were operated concurrently from 1976 to 1978 to compare escapement estimates between projects. Only the 1978 operations provided an acceptable set of data from each project. In 1978, tower counts of chinook, chum, and sockeye salmon were 56%, 37% and 47%, respectively, of the weir counts (Baxter 1979). Beginning in 1981, weir operational periods were extended to include coho salmon.

## **Methods**

### *Study Area*

The Kogrukuk River is formed by surface runoff from the north side of the plateau that divides the Tikchik Lakes and Nushagak River drainages from the Kuskokwim River drainage. Beginning at a point about five miles from Nishlik Lake, the uppermost lake of the Tikchik lakes, Kogrukuk River flows northerly for about 69 km before it joins the Chukowan River about 1.5 km above the site of Kashegelok village (Figure 1). Kogrukuk River weir is located approximately 750 km from the mouth of the Kuskokwim River, about 3 km upstream from confluence with the Chukowan River and 1 km below the confluence of Shotgun Creek.

### *Weir Design and Operation*

#### **Weir Design**

The weir consists of pickets made of 2 cm black iron pipe held in position by two angle-iron stringers (Figure 2). Each stringer is 3 m in length and perforated to receive about 45 pickets. Stringers are overlapped and braced by "A" shaped steel pipe support pods at each 3 m juncture to span the 70 m wide river. Triangular "A" pods are constructed of 3.8 cm black iron pipe (schedule 80) and Kee Klamps<sup>TM</sup><sup>2</sup>. Trap is constructed of pickets and stringers to dimensions of 1.8 m wide, 3 m long, and 1.2 m deep. It has a funnel shaped entrance and is placed just upstream of an opening in the weir. Other details of weir construction may be found in *Ignatti Weir Construction Manual* (Baxter 1981).

#### **Weir Maintenance**

The weir was usually cleaned after counting shifts. Cleaning was generally accomplished by debris being removed and placed downstream from the weir, usually accomplished with rakes and pitchforks.

Carcasses of dead salmon accumulated on the weir (hereafter referred to as carcasses) were counted by species before passing carcasses downstream of the weir.

Typically, the daily cleaning routine included visual inspection of the weir for signs of substrate scouring, damaged pickets, or other conditions that could compromise operations. Periodically, the crew conducted a more thorough inspection by snorkeling along the leading edge of the weir.

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<sup>2</sup> Mention of brand or product names does not constitute an endorsement by Alaska Department of Fish and Game.

Problems were attended to immediately. Points showing any sign of substrate scouring were addressed with sandbags or comparable means.

### **Boat Passage**

One portion of the weir contained four aluminum panels to form an operational section to allow for boat passage through the weir. Boats and rafts passing the weir were stopped and the "boat gate" opened to allow passage. Counts were made of fish that passed upstream during this process.

### **Counting Schedule**

Upstream salmon passage was enumerated each day, 4 to 8 times a day between 0730 and 2400 hours. Frequency of counting periods varied depending on fish behavior and run magnitude. The observer was positioned from either the weir boardwalk or a platform on the fish trap. When the boardwalk was used, the observer would remove four or five pickets from the weir to allow salmon passage. The weir and trap were normally closed from 2400 to 0730 hours because few salmon migrate upstream during this time.

### *Fish Passage*

All fish passing upstream of the weir through the passage gates were counted and recorded by species. The only exceptions were fish small enough to freely pass between the weir pickets. Seven data categories were tallied on different counters. The various categories were: male chinook, jack chinook, female chinook, male chum, female chum, male sockeye, female sockeye, male coho and female coho salmon.

### **Estimating Missed Salmon Passage**

Total annual escapement was determined from the total observed passage counts plus any passage estimates made for inoperable periods. The method used to make a passage estimate depended on circumstances surrounding the inoperable period. A minor breach in the weir may have been discarded if the problem was remedied quickly and unobserved passage was thought inconsequential. Otherwise, the passage estimate for a single day was calculated as the average of the observed passage one or two days before and one or two days after the inoperable period, minus any observed passage from the inoperable day. Daily passage estimates for inoperable periods lasting two or more days may have been calculated by a linear extrapolation of the average observed passage two days before and after the inoperable period using the following formula:

$$\hat{n}_{d_i} = \alpha + \beta \cdot i - n'_{d_i} \quad (1)$$

$$\alpha = \frac{n_{d_1-1} + n_{d_1-2}}{2}$$

$$\beta = \frac{(n_{d_1+1} + n_{d_1+2}) - (n_{d_1-1} + n_{d_1-2})}{2(I+1)}$$

for  $(1, 2, \dots, i, \dots, I)$

where:

$\hat{n}_{d_i}$  = passage estimate for the  $i^{\text{th}}$  day ( $1, 2, \dots, i, \dots, I$ ) of a multiple day breach event;

$n'_{d_i}$  = observed passage (if any) from a given day of the inoperable period;

$n_{d_1+1}$  = observed passage the first day after the inoperable period ( $d_1$ );

$n_{d_1+2}$  = observed passage the second day after the inoperable period;

$n_{d_1-1}$  = observed passage one day before the inoperable period;

$n_{d_1-2}$  = observed passage two days before the inoperable period;

$I$  = number of days the inoperable period lasted

This method of estimating missed passage at Kogrukluk River weir in 2002 was a change from estimating methods used in previous years. Schneiderhan (1989) used an expansion method for estimating daily counts. After the 1988 field season, he subjectively expanded historical salmon counts to the earliest and latest historical operational dates to produce a run-timing database with as many years represented as possible (Clark and Salomone 2002). Criteria for accepting a given year for inclusion into the database at that time mandated more than 50% of estimates were derived from actual counts. In 1999, acceptable criteria were changed such that only years where actual counts comprised more than 80% of the total estimated escapement were included in the database used to estimate escapement when the weir is inoperable (Clark and Salomone 2002). In 1991, the methodology for establishing run-timing models was altered. Historical daily proportions (from actual and estimated counts) were ranked across years. Run-timing models were then based on the 25th (late-run model), 50th (normal-run model), and 75th (early-run model) percentiles of the ranked daily proportions. Clark and Salomone (2002) described details about past practices for estimating missed daily passages.

### *Salmon Age-Sex-Length Composition*

Age, sex and length (ASL) composition of the total annual chinook, chum and coho salmon escapements were estimated by sampling a fraction of the fish passage and applying the ASL

composition of those samples to the total escapement. ASL data in this report represents fish that were successfully aged from scales collected.

### **ASL Sampling**

Beginning in 1992, ASL sampling plan was altered to a "pulse" sampling design described by Molyneaux and Dubois (1996). The pulse sampling goal is to collect samples from each temporal stratum in as short a time and from as many strata as possible. A minimum sample of three strata has been established for each species. Sample size goals for each time stratum were 210 chinook, 200 chum, and 170 coho salmon. Sockeye salmon were not sampled because of excessive scale reabsorption. These sample sizes were sufficient to construct simultaneous 95% interval estimates of the age composition having a maximum width of 0.20 using methods described by Bromaghin (1993). The recommended sample sizes were increased over those recommended by Bromaghin to account for the typical proportion of scale samples that are unusable. Within each stratum, a single species was sampled until the objective was achieved, after which another species was sampled.

ASL information was collected from salmon caught in the trap. Length was measured from mid-eye to fork-of-tail to the nearest millimeter and sex was determined by inspection of external characteristics. After sampling, salmon were released upstream of the weir. Scales were taken from the preferred area (INPFC 1963) and mounted on gum cards. Gum cards were pressed in acetate using methods described by Clutter and Whitesel (1956). Scale impressions were viewed through a microfiche reader and age was determined by visual identification of annuli. Ages were recorded on mark-sense forms, which were also used to record sex and length data. Completed mark-sense forms were processed through an OPSCAN machine to produce ASCII computer files. These files were then summarized using various custom computer programs. Estimates of age, sex, and length compositions from each stratum were weighted by fish passage to provide estimates for the entire escapement (Molyneaux and Dubois 2000).

Additional samples were collected for chinook salmon through active sampling. The active sampling technique required a technician positioned at the downstream end of the trap to observe fish entering the holding pen. When a chinook entered the holding pen, the technician would immediately close both the entrance and exit gates, thereby actively trapping the chinook salmon inside the holding box for sampling.

Completed gum cards and data forms were sent to the Bethel or Anchorage ADF&G office for processing.

### **Estimating ASL Composition of Escapement**

ADF&G staff in Bethel and Anchorage aged scales, processed the ASL data, and generated data summaries. DuBois and Molyneaux (2000) describe details of the processing and summarizing procedures. These procedures generated two types of data summary tables for each species, one described the age and sex composition and the other described length statistics. These summaries account for changes in the ASL composition throughout the season by first

partitioning the season into temporal strata based on pulse sample dates, applying the ASL composition of individual pulse samples to the corresponding temporal strata, and finally summing the strata to generate the estimated ASL composition for the season. This procedure ensures the ASL composition of the total annual escapement is weighted by the abundance of fish in the escapement rather than the abundance of fish in the samples. For example, if samples of chum salmon were collected in six pulses, the season would be partitioned into six temporal strata with one pulse sample occurring in each stratum. Within each stratum a sample of, for example, 190 chum salmon collected on 27 and 28 June would be used to estimate the ASL composition of the 543 chum salmon that passed the weir during the temporal strata that extended from 23 to 29 June. This procedure would be repeated for each stratum, and the estimated age and sex composition for the total annual escapement would be calculated as the sum of chum salmon in each stratum. In similar fashion, estimated mean length composition for total annual escapement would be calculated by weighting the mean lengths in each stratum by the escapement of chum salmon passing<sup>87</sup> the weir during that stratum.

Ages are reported in tables using European notation and total age. European notation is composed of two numerals separated by a decimal, the first numeral indicates the number of winters spent by juvenile fish in fresh water and the second numeral indicates number of winters spent in the ocean (Groot and Margolis 1991). Total age of a fish is equal to the sum of these two numerals, plus one to account for the pre-juvenile winter when the egg was incubating in gravel. Chinook salmon age-1.4 fish under the European notation is actually 6 years of age. European notation can be confusing for non-technical readers, so fish ages are presented in the text of this report as the total age.

### ***Mark-Recapture Tag Recovery***

Three mark-recapture tagging studies were conducted in 2002, two in the mainstem Kuskokwim River and one in the mainstem Holitna River. The Kogrukluik River weir and other weir projects in the Kuskokwim River drainage were integrated into these studies. In one study, chum, coho and sockeye salmon were tagged near Kalskag and Aniak in an effort to estimate the total abundance of these species in the Kuskokwim River (Carol Kerkvliet, ADF&G Anchorage, personal communication). Kogrukluik River weir served as a tag recovery location and collected information on fish that had numbered spaghetti tags attached. Weir crews were responsible for gathering three sets of data associated with this study. First, crews captured tagged fish in the fish trap and recorded the date of capture, species, tag number, tag color, presence of secondary marks and the general condition of the fish. Tagged fish were captured in a manner comparable to active sampling described for the ASL sampling of chinook salmon. Visibility was enhanced through the use of a clear-bottom viewing box that reduced glare and water turbulence. Tagged fish were released upstream of the weir with the tag attached.

The second dataset collected in association with the mainstem Kuskokwim River mark-recapture study was a daily summary of tagged versus untagged salmon. The design of the mark-recapture study acknowledged unlikely all tagged fish observed would be captured. Tagged fish not

captured had their tag color recorded and added to the daily tally of captured fish from the first dataset.

The third dataset collected in association with this mark-recapture study focused on determining incidence of tag loss by examining fish for clipped adipose fins. Fish that received a numbered spaghetti tag had their adipose fin clipped as a secondary mark. Crews examined fish caught in the fish trap for secondary marks. The daily goal was to examining 80 fish of each species, depending on abundance. The sample population included all fish caught as part of ASL sampling, plus additional fish caught solely for purpose of examining for secondary marks.

The second mark-recapture tagging study to involve the Kogrukuk River weir was a radio telemetry project intended to estimate the total abundance of chinook salmon in the Kuskokwim River (Lisa Stuby, ADF&G Fairbanks, personal communication). Radio transmitters were inserted into chinook salmon caught near Aniak. Three radio receiver stations were placed in Holitna River drainage; one on Hoholitna River, one on Holitna River, and the third on Kogrukuk River near the weir site. The known chinook salmon passage at the weir, coupled with data collected from the receiver station, was used with similar data collected at other weir projects to develop estimates of total chinook salmon abundance.

Third mark-recapture tagging study was conducted on the mainstem Holitna River and radio tagged chinook, chum, and coho salmon (John Chythlook, ADF&G Fairbanks, personal communication). Chinook, chum, and coho salmon were captured near the mouth of the Holitna River and transmitters were inserted to determine the abundance and distribution of these stocks in the Holitna River drainage. This project used the same receiving stations as the previously described project.

#### *Climatological and Hydrological Monitoring*

Water and air temperatures were measured at the Kogrukuk River weir each day at approximately 07:30 and 17:00 hours. Water temperature was determined by submerging a calibrated thermometer below the water surface for a few minutes until the temperature stabilized. Air temperature was measured from a thermometer attached to an outside wall of the cabin located in a shaded location. These temperatures were recorded on daily observation forms along with notations about wind direction, estimated wind speed, cloud cover, and precipitation. The amount daily precipitation was measured using a rain gauge.

River depth was monitored daily with a standardized staff gauge, which consisted of a metal rod driven into the stream channel with a meter stick attached. Height of the water surface, as measured from the meter stick, represented the "stage" of the river above an established datum plane. The staff gauge was calibrated to the datum plane by a semi-permanent benchmark, for consistent measurements between years. Benchmark is a nail driven into the second step of the stairs near the cabin, which represents a measurement of 5,000 mm above baseline. Water stage was measured at approximately 7:30 and 17:00 hours.

## RESULTS

### *Weir Operations*

Weir instillation began on 23 June and was operational from 26 June to 24 September 2002. The weir had three inoperable periods; 18 July a counting gate was left unattended, 20 and 21 July a hole in the weir was discovered, and from 3 to 5 Augusts the crew re-aligned the fish trap and bipods. Estimates were made for inoperable periods using methods previously described.

### *Fish Passage*

#### **Chinook Salmon**

Total annual chinook salmon escapement upstream from the Kogrukuk River weir in 2002 was 10,104 fish, including 514 chinook salmon (5%) estimated to have passed when the weir was inoperable (Table 1). The 2002 total annual chinook salmon escapement exceeded the minimum SEG of 10,000 fish. Chinook salmon were observed passing upstream of the weir from 26 June to 31 August. Peak daily passage of 1,192 chinook salmon occurred on 6 July. Median passage date for the season was 11 July, and central fifty-percent of the passage occurred between 6 and 16 July.

#### **Chum Salmon**

Total annual chum salmon escapement past the weir in 2002 was 51,570 fish, including 2,076 chum salmon (4 %) estimated passed when the weir was inoperable (Table 1). The 2002 total annual chum salmon escapement exceeded the minimum SEG of 30,000 fish. Chum salmon were observed passing upstream of the weir from 26 July to 24 September when weir operations were discontinued for the season. Peak daily passage of 3,402 chum salmon occurred on 11 July, which coincided with the median passage date for the season. Central fifty-percent of the passage occurred between 7 and 17 July.

#### **Sockeye Salmon**

Total annual sockeye salmon escapement past the weir in 2002 was 4,050 fish, including an estimated 137 sockeye salmon (3.4 %) that passed when the weir was inoperable (Table 1). Sockeye salmon were observed passing upstream of the weir from 26 June to 7 September. Peak daily passage of 491 fish occurred on 8 July. Median passage date was 11 July, central fifty percent passage occurring between 6 and 15 July.

## Coho Salmon

Total annual coho salmon escapement past the weir in 2002 was 14,516 fish, including an estimated 15 coho salmon (less than 1%) that passed when the weir was inoperable (Table 1). The 2002 total annual coho salmon escapement was 58% of the minimum SEG of 25,000 fish. Coho salmon were observed passing upstream of the weir from 22 July to 24 September when weir operations were discontinued for the season. Peak daily passage of 1,350 coho salmon occurred on 31 August, which coincided with the median passage date in 2002. Central fifty-percent passage occurred between 24 August and 5 September.

## Pink Salmon

Fifteen pink salmon were observed passing upstream of the Kogrukluk River weir in 2002, plus an unknown number of pink salmon passed upstream through the spacing between weir pickets.

### *Age-Sex-Length Data*

## Chinook Salmon

Age was determined for 466 chinook salmon, which accounts for 5.0% of the total annual chinook salmon escapement in 2002 (Tables 2, 3). The chinook salmon run was partitioned into four strata based on the temporal distribution of the sampling effort.

Age-5 fish predominated and accounted for 50.0% of the total annual escapement. Age-6, -4, and -7 chinook salmon accounted for 31.2%, 17.4%, and 1.4% of the total annual escapement respectively.

Female chinook salmon comprised 33.1% of the total annual escapement based on fish successfully aged (Table 2), and 26.3% based on sex determination made by the crew during fish counts (Table 1). Young male chinook salmon (age 4) were more abundant during early stages of the run and diminished as the season progressed.

Lengths for female chinook salmon ranged from 667 to 979 mm and from 455 to 997 mm for males (Table 3). Average lengths for females age 5, 6 and 7 were 777, 857, and 882 mm, respectively. Average lengths for males age 4, 5, 6, and 7 were 563, 684, 769, and 945 mm, respectively.

## Chum Salmon

Age was determined for 999 chum salmon, which accounted for 1.9% of the total annual chum salmon escapement in 2002 (Tables 4, 5). Samples were collected in six pulses of 200 fish per

pulse and partitioned into six temporal strata based on the temporal distribution of sampling effort.

Age-4 chum salmon were dominate comprising 75.7% of the total annual escapement, while age-5, -6, and -3 fish accounted for 23.1%, 1.1%, and 0.2% of the total annual escapement respectively (Table 4). Proportion of older-aged fish (age 5 and 6) was 57.0% early in the run and diminished to 10.4% as the run progressed.

Female chum salmon comprised 15.1% of the total estimated chum salmon annual escapement based on scales that were successfully aged (Table 4), and 20.1% based on the sex determination made by the crew during fish passage (Table 1). Comparing proportion of females between six strata showed no distinctive trend as the season progressed.

Lengths for female chum salmon ranged from 489 to 629 mm and from 501 to 696 mm for males (Table 5). Average lengths for females age 3, 4, 5 and 6 were 523, 551, 560 and 555 mm, respectively. Average lengths for males age 3, 4, 5 and 6 were 548, 579, 598 and 609 mm, respectively. As the season progressed, average length tended to decrease for both sexes and for all age groups (Figure 3).

### Coho Salmon

Age determinations for 423 coho salmon accounted for 2.9% of the total coho salmon annual escapement in 2002 (Tables 6, 7). Samples were collected in three pulses with sample sizes of 160, 149, and 114 fish. Coho salmon total annual escapement was partitioned into three temporal strata based on sampling dates.

Only two age classes occurred in ASL data for coho salmon at Kogrukuk River weir, age-4 and -5, and comprised 86.4% and 13.6% of the total annual escapement, respectively (Table 6).

Female coho salmon comprised 30.9% of the total annual escapement based on fish that were successfully aged (Table 6), and 35.0% based on the sex determination made by the crew during fish passage (Table 1). Percentage of females remained relatively constant throughout the season.

Lengths for female coho salmon ranged from 492 to 630 mm and from 456 to 654 mm for males (Table 7). Average length for females age 4 and 5 were 564 and 578 mm. Average length for males age 4 and 5 had were 557 and 571 mm. No trends were seen in average length as the season progressed.

### *Mark-Recapture Tag Recovery*

## **Mainstem Kuskokwim River Chum and Coho Salmon Mark-Recapture Study**

Findings from the mainstem Kuskokwim River mark-recapture study will be described separately in a report authored by Carol Kerkvliet (*in prep.*). Eighty-three numbered spaghetti tagged chum salmon from this study were observed passing the Kogrukluk River weir and tag information was recovered for 66 of the fish (Appendix A.1.). The 83 tagged chum salmon represent 0.2% of the observed passage of 49,494 fish. Examination for secondary marks was done on 2,077 chum salmon, 4% of the observed passage, and no untagged chum salmon were found to have a secondary mark.

Twelve numbered spaghetti tagged sockeye salmon recaptured at the Kogrukluk weir in 2002 represents 0.3% of the observed sockeye salmon passage of 3,913 fish. Examination for secondary marks was done on 39 sockeye salmon, 1% of the observed passage, and no untagged sockeye salmon were found to have a secondary mark.

Numbered spaghetti tagged coho salmon observed passing the weir were 248 and tag information was recovered for 208 of these fish (Appendix A.2.). The 248 tagged coho salmon represent 1.7% of the observed passage of 14,501 fish. Examination for secondary marks was done on 718 coho salmon, 5.0% of the observed passage, and no untagged coho salmon were found to have a secondary mark.

### **Radio Telemetry Mark-Recapture Study**

John Chythlook reported results of the Holitna River radio telemetry project (*in prep.*), and Lisa Stuby will report results from the mainstem Kuskokwim River radio telemetry project (*in prep.*). A total of 18 radio tagged chinook salmon passed the radio receiver station installed near the weir; 12 of these radio tags were deployed from the mainstem Holitna River project and six were deployed from the mainstem Kuskokwim River project. Five radio tagged chum and five coho salmon tagged in conjunction with the Holitna River tagging project passed the Kogrukluk River weir in 2002 (John Chythlook, ADF&G Fairbanks, personal communication).

### *Climatological and Hydrological Conditions*

Water temperature ranged from a peak of 17°C on 2 July to a low of 4°C on 21 September (Appendix B.1.). Average water temperature at the weir was 7.2°C for the overall operational period in 2002.

Water levels ranged from 3230 mm on 21 June to 2475 mm on 19 August (Appendix B.1.). Water levels in the Kogrukluk River averaged 2736 mm for the overall operational period in 2002.

Air temperature at the weir ranged from 28°C on 18 July to -3°C on 21 September (Appendix B.1.). Average air temperature at the weir was 11.8°C for the overall operational period in 2002.

## DISCUSSION

### *Weir Operations*

Overall, operation of the Kogruklu River weir in 2002 was a near flawless success. Three short periods when the weir was inoperable were on 18 July a passing gate was left unattended for a few hours, on 20 and 21 July a hole was discovered in the weir leaking chinook, chum and sockeye salmon, and from 3 to 5 August when the crew dismantled portions of the weir to readjust bipods and fish trap.

### *Fish Passage*

#### **Chinook Salmon**

**Abundance.** Reported escapement of 10,104 chinook salmon past the Kogruklu River weir is a reliable estimate of the total annual chinook escapement upstream of the weir in 2002 (Table 1). The estimated 514 fish that passed during the three inoperable periods only accounted for 5.1% of the total annual escapement.

Escapement of 10,104 chinook salmon in 2002 was above the minimum SEG of 10,000 fish for the first time since 1998 (Figure 4; Appendix C.1.). The 2002 escapement was markedly better than what occurred in 1999 and 2000, years that contributed to the BOF classifying Kuskokwim River chinook salmon as a stock of concern (Burkey et al 2000a). A comparable improvement in escapement was seen at weirs operated on the Kwethluk, Tuluksak and Tatlawiksuk Rivers (Table 8), and in aerial surveys flown on the Kisaralik, Aniak, Kipchuk, Salmon (Aniak River drainage), Holokuk, Oskawalik, and Salmon (Pitka Fork River drainage) Rivers. The only Kuskokwim River tributaries without some improvement in 2002 chinook escapement were the George and Takotna Rivers.

Chinook salmon escapements to the Kogruklu River would likely have been lower but for two conservation measures taken in response to the BOF designating Kuskokwim River chinook salmon as a stock of concern (Burkey et al. 2000a). One of these measures was closure of the Kuskokwim River commercial salmon fishery in June. Total commercial harvest of chinook salmon was limited to 72 fish in 2002, whereas the 10-year average harvest is 18,081 fish per year (Burkey et al. 2002).

The second conservation measure was implementation of a subsistence fishing schedule throughout the Kuskokwim River drainage. This schedule was first invoked in 2001 and required all Kuskokwim River subsistence fishers to remove their nets and to stop their fish wheels for three consecutive days each week in accordance with a prearranged schedule. In 2002, the schedule was discontinued after 28 June when most run assessment tools suggested the measure was no longer needed. Thereafter, subsistence fishing was allowed seven days a week.

Chinook salmon had just begun arriving at the Kogrukluuk River by 28 June, so any savings from local impacts from the schedule was probably minimal. Still, Kogrukluuk and other Kuskokwim River tributaries likely benefited from the schedule because June closures provided windows for fish passage though the subsistence fishery of the lower Kuskokwim River. Unfortunately, the degree of benefit is unknown.

**Run Timing.** Run timing of Kogrukluuk River chinook salmon in 2002 was near average. Median passage date in 2002 was 11 July, one day earlier than the historical average (Appendix C.2.). The earliest historical median passage date for the Kogrukluuk River chinook salmon occurred on 7 July in 1981 and 1996, and the latest date occurred on 20 July in 1999. Central fifty-percent passage in 2002 occurred from 7 to 17 July, one day earlier than the historical average.

**Carcasses.** Records were kept regarding the occurrence of chinook salmon carcasses washing downstream onto the weir (Table 9; Figure 5). A total of 1,634 carcasses were found, the first appeared on 7 July and the last found on 13 September. Carcass midpoint passage was 2 August, 22 days after the median upstream passage date of 11 July. These observations reassure timing of aerial surveys flown on 27 July coincided with peak abundance of chinook salmon on the spawning grounds, inclusive of carcasses.

## Chum Salmon

**Abundance.** Reported escapement of 51,570 chum salmon past the Kogrukluuk River weir is a reliable estimate of the total annual chum escapement upstream of the weir in 2002 (Table 1). The estimated 2,076 fish that passed upstream during three inoperable periods only accounted for 4.0% of the total annual escapement.

Escapement of 51,570 chum salmon in 2002 was above the minimum SEG of 30,000 fish, and was the third highest escapement recorded since the project began in 1976 (Figure 4; Appendix C.1.). The 2002 escapement was markedly better than the escapements of 1997, 1999, and 2000, years that contributed to the BOF classifying Kuskokwim River chum salmon as a stock of concern (Burkey et al. 2000b). Improved escapements were also observed at the weir projects operated on the Kwethluk, Tatlawiksuk and Takotna Rivers, and in the sonar project on the Aniak River (Table 8). The only tributaries projects where improved escapements were not observed were the George and Tuluksak River weirs.

Chum salmon escapements to the Kogrukluuk River would likely have been lower but for two conservation measures taken in response to the BOF designating Kuskokwim River chum salmon as a stock of concern (Burkey et al. 2000b). One of these measures was closure of the Kuskokwim River commercial salmon fishery in June, and the other was implementation of a subsistence fishing schedule throughout the Kuskokwim River drainage as described earlier. These two actions were of particular consequence to Kogrukluuk River chum salmon because June is when this spawning aggregate passes through the lower Kuskokwim River, as evidenced by tag recoveries from the Kalskag-Aniak mark-recapture project operated in 2002 (Figure 6). Absence of a commercial fish processor in the lower Kuskokwim River until late July essentially

precluded commercial fishing until nearly all chum salmon had passed through the commercial fishing districts and likely increased chum salmon abundance in the Kuskokwim River drainage. Consequently, the total commercial harvest of chum salmon in 2002 was limited to 1,900 fish, whereas the 10-year average harvest is 216,406 fish per year (Burkey et al. 2002).

**Run Timing.** Run timing of Kogrukuk River chum salmon in 2002 was near average. The date of median passage was 11 July, two days earlier than the historical average (Figure 4; Appendix C.3.). The earliest median passage date occurred on 9 July in 1981, 1988 and 1996, while the latest date was on 19 July in 1991 and 2001. Central fifty-percent passage in 2002 occurred from 7 to 17 July, about one or two days earlier than the historical average.

**Carcasses.** Records were kept regarding the occurrence of chum salmon carcasses washing downstream onto the weir (Table 9; Figure 5). A total of 17,462 carcasses were found, the first appeared on 26 June and the last on 17 September. The midpoint of the carcass passage was 25 July, 14 days after the median upstream passage date of 11 July, and appeared to be in post-spawning condition. The aerial survey of the Kogrukuk River drainage occurred on 27 July, two days after the median carcass passage date and likely late in regard to the peak spawning abundance in the system.

## Sockeye Salmon

**Abundance.** Reported escapement of 4,050 sockeye salmon past the Kogrukuk River weir is a reliable estimate of the total annual sockeye escapement upstream of the weir in 2002 (Table 1). The estimated 137 fish that passed upstream during the three inoperable periods accounted for only 3.4% of the total annual escapement.

Escapement of 4,050 sockeye salmon in 2002 was the eighth lowest escapement past the Kogrukuk River weir since 1979 (Figure 7; Appendix C.1.). Annual escapement in 2002 was 48% of the average sockeye escapement of 8,538 fish since operations started in 1979.

**Run Timing.** Run timing of Kogrukuk River sockeye salmon in 2002 was early. Median passage date in 2002 was 11 July, four days earlier than the historical average (Appendix C.4.). The earliest historical median passage date for Kogrukuk River sockeye salmon occurred 9 July in 1981 and the latest date was 22 July in 1999. Central fifty-percent passage in 2002 occurred from 6 to 15 July, four to five days earlier than the historical average.

**Carcasses.** Records were kept on the occurrence of sockeye salmon carcasses washing downstream onto the weir (Table 9; Figure 5). A total of 611 carcasses were found, the first appeared on 6 July and the last on 15 September. Midpoint for carcasses passage was 17 August, 37 days after median upstream passage date of 11 July and most appeared to be in post-spawning condition. Aerial survey of the Kogrukuk River drainage occurred on 27 July, when 98% of the upstream migration had occurred and only 1% of the carcasses had drifted down to the weir. Based on these numbers, aerial surveys coincided with the peak spawning abundance in the system, although no sockeye salmon were reported from the aerial survey data.

## Coho Salmon

**Abundance.** Reported escapement of 14,516 coho salmon past the Kogrukluk River weir is a reliable estimate of the total annual coho escapement upstream of the weir in 2002 (Table 1). The 15 fish estimated to have passed upstream during three inoperable periods accounts for less than 1% of total annual escapement.

Escapement of 14,516 coho salmon in 2002 fell short of the minimum SEG of 25,000 fish (Figure 7; Appendix C.1.). Kuskokwim River coho salmon have not been identified as a stock of concern by the BOF; however, total annual coho salmon escapement to the Kogrukluk River has fallen short of the SEG in 5 of the past 6 years. Kogrukluk River is the only tributary in the Kuskokwim Area with an established escapement goal.

Historically, escapements to the Kogrukluk River increased from a record low in 1990 to the record high in 1996, but since 1996 the escapements have been well below the minimum SEG. Commercial coho salmon harvest in the Kuskokwim River has followed a similar pattern with harvest increasing from 1990 to the record high harvest in 1996, followed by a dramatic plunge to below average harvests since 1996 (Burkey et al. 2002). As an example, the commercial coho salmon harvest in 2002 was 83,463 fish compared to the 10-year average harvest of 453,755 fish (Burkey et al. 2002). Decreases in harvest of the commercial fishery is partly caused by limited processing capacity, but low escapements to the Kogrukluk River support the conclusion overall abundance of coho salmon runs in the Kuskokwim River have been depressed since 1996. No special measures were taken to conserve coho salmon in the 2002 subsistence fishery, but average annual subsistence harvest is less than 35,000 fish (Burkey et al. 2002).

Kogrukluk River is the only tributary in the Kuskokwim Area with a long-term history of coho salmon escapement monitoring, but in recent years escapement monitoring has been initiated in the Kwethluk, Tuluksak, George, Tatlawiksuk and Takotna Rivers (Table 5). Most escapement data from these newer projects was accrued after 1996, so to put the escapement numbers in context with the trends observed at the Kogrukluk River is difficult.

**Run Timing.** Run timing of Kogrukluk River coho salmon in 2002 was near average. Median passage date was 31 August, one day earlier than the historical average (Appendix C.5.). The earliest historical median passage date occurred on 25 August in 1996 and the latest date was on 10 September in 1990. Central fifty-percent of the 2002 passage occurred from 24 August to 5 September, which was one to three days earlier the historical average.

**Carcasses.** Records were kept regarding occurrence of coho salmon carcasses washing downstream onto the weir, but assessment is incomplete because the removal date of the weir was likely before most carcasses had washed downstream (Table 9; Figure 5).

### *Salmon Age-Sex-Length Composition*

Sample sizes for most ASL pulses collected in 2002 were below objectives, as was the case in previous years. Achieving objectives for each pulse sample was weighed against the need for collecting the samples over a brief period of time, abundance of the species, and avoiding undue delay in salmon migration. Chinook salmon were actively captured to increase sample size.

#### **Chinook Salmon**

ASL data collected from chinook salmon at the Kogruklu River weir was adequate for describing the age composition for the total annual escapement in 2002 (Table 2, 3). Age composition of Kogruklu River chinook salmon in 2002 is encouraging for expectations about the 2003 run outlook. Chinook salmon runs are typically dominated by age-5 and age-6 fish (DuBois and Molyneaux 2000), but the abundance of age-4 and age-5 fish in one year can provide insight for returns of age-5 and age-6 fish in the following year. Chinook salmon age 4 accounted for 1,754 fish in the 2002 Kogruklu River escapement, which is an increase over the 303, 327, and 1,425 age-4 chinook salmon that returned in 1999, 2000 and 2001 (DuBois and Folletti, unpublished). If this trend continues, abundance of age-5 fish in 2003 should be greater than was observed in 2002. Age-5 chinook salmon, in 2002 accounted for 5,054 fish in the Kogruklu River escapement, which again is an increase over the 1,404, 1,630 and 3,656 age-5 fish that returned in 1999, 2000 and 2001. Abundance of age-5 fish in 2002 may forecast an increase in the abundance of age-6 chinook salmon in 2003. Expected increases in age-5 and age-6 fish in 2003 should provide for an increased overall run of Kogruklu River chinook salmon in 2003. Caveats to this interpretation are the unknown proportion of Kogruklu River fish being harvested and the implications of the closed commercial fishery and subsistence fishing schedule. Still, countering these caveats is the fact that Kuskokwim River commercial chinook salmon harvest has diminished since 1999 to less than 5,000 fish per year and the subsistence harvest in the Kuskokwim River has remained relatively stable (Burkey et al. 2002), plus the subsistence fishing schedule will likely be invoked again in 2003 for the third consecutive year.

Females chinook salmon accounted for 25.5% of total annual chinook salmon escapement based on the weighted ASL samples (Table 2), which is comparable to the 26.3% estimated by the field crew during daily fish passage (Table 1). These percentages are among the lowest observed over the history of the project (DuBois and Molyneaux 2000), but total number of 2,580 (based on weighted ASL samples) females in the escapement is not alarming. The low percentage is strongly influenced by the predominance of age-4 and age-5 fish, which are mostly males.

Length composition data collected on chinook salmon at the Kogruklu River weir in 2002 showed a general decrease in all age classes compared to the historical totals, except for males age 7 (Table 3.). Female chinook salmon age 5 and 6 had a mean length of 777 and 857 mm in 2002 compared to 782 and 867 mm for the historical total. Young male chinook salmon, age 4, mean length was nearly the same in 2002 compared to the historical total, 563 and 569 mm

respectively. No discernible pattern in mean lengths for female or male chinook salmon was observed in 2002.

### **Chum Salmon**

ASL data collected from chum salmon at Kogruklu River weir was adequate for describing age composition for total annual escapement in 2002. Older-aged chum salmon were prominent early in the run and diminished as the season progressed from 57.0% to 10.4% for age-5 and 6 fish (Table 4). This same pattern has been commonly observed at other escapement monitoring projects in the Kuskokwim Area (DuBois and Molyneaux 2000).

Chum salmon runs in the Kuskokwim River consist primarily of age-4 and age-5 fish with average age composition in the Kogruklu River generally split evenly between these two age classes (DuBois and Molyneaux 2000). In 2002 age-4 fish dominated the near record escapement, accounting for 75.7% of the total annual escapement to the Kogruklu River (Table 4). Abundance of age-4 fish in 2002 may predict similar abundance for age-5 fish in 2003; however, historic datasets do not indicate a strong sibling relationship for Kogruklu River chum salmon. Variables confounding interpretation of sibling relationships include unknown numbers of Kogruklu River chum salmon harvested each year and the challenge of aging partially reabsorbed fish scales collected from the escapement.

Sex composition of Kogruklu River chum salmon has been the subject of some concern. Most chum salmon ASL data sets in the Kuskokwim River show a fairly even split between females and males (DuBois and Molyneaux 2000). Kogruklu River has been an exception with female composition being as low as 4.1%, as was determined from ASL samples collected in 1997. Low female percentages mostly occur since 1990, during which time females averaged 16.1% of the total annual escapements. Staff members have speculated on the cause of this phenomenon and reached general consensus low female percentages are an artifact caused by differences in the spawning behavior between female and male chum salmon. Considerable chum salmon spawning occurs downstream of the weir in the mainstem Holitna River and spawning males may tend to continue migrating upstream a considerable distance, spawning with females along the way, females may tend not to stray far from their redds. This theory has some basis in findings reported by Schroder (1982) whereby male chum salmon in Big Beef Creek, Washington, remained sexually active for 10 to 14 days, but females completed spawning in 2 days. Still this behavior does not explain why the phenomenon at Kogruklu River has become more prominent in the 1990s. The mark-recapture project in the mainstem Kuskokwim River may offer some insight to the low proportion of female chum salmon seen at the Kogruklu River weir.

Mean lengths of chum salmon by sex and age class sampled in 2002 were generally smaller than the historical total (Table 5). The reasons for the decrease in mean length compared to the historical total is not known.

## **Coho Salmon**

ASL data collected from coho salmon at Kogrukluk River weir was adequate for describing the age composition for the total annual escapement in 2002 (Table 6, 7). Age composition included only age-4 and age-5 fish in 2002 (Table 6). Total annual escapement was dominated by age-4 fish, which accounted for 86.4% of the total escapement, but was lower than the historical total of 92.3%. Dominance of age-4 coho salmon is typical in the Kuskokwim Area (DuBois and Molyneaux 2000).

The proportion of female coho salmon decreased to 30.9% in 2002 compared to the historical total of 38.1% (Table 6).

Mean length for coho salmon in 2002 were near their historic totals for both sexes and age classes (Table 7). The difference in mean length in 2002 was less than 10 mm for both sexes and age classes. No noticeable length trends developed as the run progressed.

### ***Mark-recapture Tag Recovery***

Carol Kerkvliet and Toshihide Hamazaki will discuss findings from the mainstem Kuskokwim River mark-recapture study in a separate report (*in prep.*). Highlights related to the Kogrukluk River are discussed below.

## **Chum Salmon**

Eighty-three tagged chum salmon were observed passing the Kogrukluk River weir and the distribution of these tagged fish in overall Kogrukluk River escapement was shifted toward an earlier part of the run (Figure 8). This shift may have been a consequence of reduced tagging rate when increased fish abundance at the tagging site precluded the tagging of every fish caught.

Original tagging date could be determined for 66 tagged fish recovered at the weir (Appendix A.1.), and 89% of those fish were tagged during first 25% of chum salmon captured at the Kalskag-Aniak tagging sites (Figure 6). These findings indicate chum salmon migrating to the Kogrukluk River occur early in the overall Kuskokwim River chum salmon run. Similar timing was observed for tagged fish recovered at the Takotna River weir (Clark and Molyneaux 2003); in fact, some separation appears in the timing of various spawning aggregates with upper river stock occurring earlier in the season, progressing to successively later run timings for spawning aggregates located farther downstream (Figure 6). In addition, travel time between Kogrukluk River and the Kalskag-Aniak tagging site was 9 to 19 days and the migration speed ranged from 14 to 26 miles per day.

Tagged fish percentage in the total annual chum salmon escapement passing the Kogrukluk River weir was relatively small (0.17%) compared to the percentage observed at the other monitored tributaries that included the George and Tatlawiksuk Rivers (Carol Kerkvliet,

ADF&G Anchorage, personal communication). The lower incidence of tagged chum salmon in the Kogruklu River indicates this spawning aggregate had a lower probability of capture at the tagging site than did chum salmon from the other tributaries. Kerkvliet and Hamazaki (*in progress*) will discuss details of the 2002 tagging project. Chum salmon were being caught at the Kalskag-Aniak tagging site at the start operations (14 June at Aniak and 18 June at Kalskag), and a few days were needed to get the project fully operational. Tags recovered indicate the Kogruklu River fish were more prominent during the start up phase when tagging effort was not at full capacity. In addition, water levels in the mainstem Kuskokwim River were higher in the early part of the season and may have had the result of making the fish wheels less efficient in catching fish during the early portion of the overall Kuskokwim River chum salmon run (Dave Folletti, ADF&G Anchorage, personal communication).

Of 2,077 chum salmon examined for secondary marks, no untagged fish were found to have a secondary mark. The conclusion from this finding is tag loss was not occurring.

### **Coho Salmon**

Two hundred forty-eight tagged coho salmon were observed passing the Kogruklu River weir and the distribution of the tagged fish in the overall escapement was shifted toward the later part of the run (Figure 9). The cause of the shift is unclear, but may be related to changes in tagging rate or a lag-time induced by fish handling during tagging.

Original tagging date could be determined for 208 tagged fish recovered at the weir (Appendix A.2.). Tagged fish returning dates were well distributed throughout the daily catches at the Kalskag-Aniak tagging sites, indicating no distinctive run timing for Kogruklu River coho salmon in comparison to the overall coho run at the tagging site (Figure 10). The midpoint for coho salmon captures at the tagging sites was 19 August, whereas the midpoint at the tagging sites for tagged fish recovered at the Kogruklu River weir was 20 August.

Travel time between the Kalskag-Aniak tagging sites and the Kogruklu River was from 10 to 34 days, with the average travel time from Kalskag and Aniak to the weir being 17 and 18 days, respectively (Appendix A.2.). Migration speed from the tagging sites to the Kogruklu River weir ranged from 9 to 28 miles per day and averaged from 17 to 15 miles per day from Kalskag and Aniak respectively. Migration speed tended to increase as the season progressed.

Of 718 coho salmon examined for secondary marks, no untagged fish were found to have a secondary mark. The conclusion from this finding is tag loss was not occurring.

### *Climatological and Hydrological Monitoring*

Water levels in the Kogruklu River were near average throughout most of the operational period. The weir experienced no high water events in 2002. The highest water level record occurred on 21 June, the first day of observation (Appendix B.1.).

Water level in the Kogrukuk River in 2002 seemed to have little affect on the migration of chinook, chum and sockeye salmon (Figure 11). An increase in water level on 20 and 31 August was mirrored by increase in coho salmon passage. This behavior for coho salmon has been observed in other stocks throughout their range (Sandercock 1991).

Reported water temperature for the Kogrukuk River ranged from 4°C to 17°C during the 2002 operations (Appendix B.1.). The average water temperature of 10.5°C in 2002 was lower than the historic average water temperature of 11.2°C. In 2002, fluctuations in daily water temperatures did not appear to affect salmon passage (Figure 12).

## RECOMMENDATIONS

1. One challenging aspect of the historic dataset for the Kogrukuk River weir is variability in start and stop dates for the project, which sometimes confounds between-year comparability of summary statistics such as the total annual escapement. Circumstances that dictate start and stop dates for a project are often beyond the control of project leaders or crews, but the comparability of summary statistics can be enhanced by conformation to a standardized target operation period. A target operational period would need to balance between what historically has been shown to be practical start and stop dates while providing a reasonable assessment of the total escapement estimate for each species. Project leaders would be required to estimate fish passage for inoperable periods that occurred within the target operational dates. Furthermore, counts made before or after the target operational period would be omitted from the summary statistics reported for the project.
2. Kogrukuk River has the longest history of salmon escapement monitoring in the Kuskokwim Area, but inquiry into the rich history of data collected at this project is allusive because the limited historic perspective provided by the standard project report. Future project reports for the Kogrukuk River weir should include more historical perspective such as the following:
  - a. brood tables and three dimensional graphics that illustrate the number of fish by age class for the recent past,
  - b. differences in sex composition as determined from weighted ASL samples and crew counts (both percent and total number),
  - c. trends in the number and percent of females in the escapement,
  - d. and trends in average length at age and sex.
3. Estimates of total annual escapement currently date to 1976, but extension of that timeline back to 1969 when a counting tower was operated may be possible. Some paired data does exist for years when both the tower and weir operated concurrently. Revisiting the counting tower data may allow for estimates of total annual salmon escapement in light of the current state of knowledge about the Kogrukuk River salmon populations back to 1969.

4. A spawner-recruit analysis for Kogrukluk River salmon is another initiative with some merit. One of the caveats in undertaking this initiative in the past was accounting for the unknown fraction of Kogrukluk River fish harvested in the commercial and subsistence fisheries. Preliminary findings from the mark-recapture projects operated in 2002 provided insight into the timing of Kogrukluk River salmon stocks in the lower Kuskokwim River, which may allow for some reasonable assumptions as to what temporal fraction of harvest is likely to contain fish bound for the Kogrukluk River. Isolating harvest during that time period, and applying an estimated spawning stock apportionment, to account for Kogrukluk River fish, may provide the resolution required for identifying a reasonable spawner-recruit relationship.
5. Throughout most of the 1990s the percentage of female chum salmon in the Kogrukluk River escapements has been in the teens, which contrasts with the approximately fifty-percent split between females and male in nearly every other Kuskokwim Area data set. This low percentage raises concerns about how representative the Kogrukluk River chum salmon sex composition is to the Holitna River drainage in general. Operation of the Holitna River radio telemetry project provides some opportunity to resolve this question and comparison between the two projects should be incorporated into future Kogrukluk River project reports.
6. Another ASL issue to be discussed is the variability of the salmon sex determination from the ASL samples compared to weir crew estimate derived from the daily counting routine.
7. Finally, various mark-recapture and radio telemetry projects operated since 2000 provide an opportunity for additional insights about the Kogrukluk River salmon populations. Time limitations and primary focus of these projects may preclude investigators from following up on some additional prospects. Some prospects include variations in run timing and swimming speed both within season and between seasons. Future Kogrukluk River weir reports should follow up on some of these prospects on a multi-year comparison basis.

## LITERATURE CITED

- Alaska Administrative Code 2001. Policy for the Management of Sustainable Salmon Fisheries, 5AAC.39.222.
- Baxter, R. 1976. Holitna Weir developmental project, 1976. AYK Region Kuskokwim Salmon Escapement Report No. 11. Alaska Department of Fish and Game, Division of Commercial Fisheries, Anchorage.
- Baxter, R. 1979. Holitna River salmon studies, 1978. AYK Region Kuskokwim Salmon Escapement Report No. 15. Alaska Department of Fish and Game, Division of Commercial Fisheries, Anchorage.
- Baxter, R. 1981. Ignatti weir construction manual. Alaska Department of Fish and Game, Division of Commercial Fisheries, AYK Region Kuskokwim Salmon Escapement Report No. 28, Anchorage.
- Bromaghin, J.F. 1993. Sample size determination for interval estimation of multinomial probabilities. *The American Statistician* 47 (3): 203-206.
- Buklis, L.S. 1993. Documentation of Arctic-Yukon-Kuskokwim region salmon escapement goals in effect as of the 1992 fishing season. Regional Information Report No. 3A93-03. Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division, Anchorage.
- Buklis, L.S. 1999. A description of economic changes in commercial salmon fisheries in a region of mixed subsistence and market economies. *Arctic*. 52 (1): 40-48
- Burkey, C.E. Jr., editor. 1994. Kuskokwim Area salmon escapement observation catalog, 1984-1994. Regional Information Report No. 3A94-36. Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division, Anchorage.
- Burkey, C.E. Jr., and six co-authors. 1999. Annual management report for the subsistence and commercial fisheries of the Kuskokwim Area, 1998. Regional Information Report No. 3A99-36. Alaska Department of Fish and Game, Division of Commercial Fisheries, Anchorage.
- Burkey, C.E. Jr. and P.G. Salomone. 1999. Kuskokwim Area Salmon Escapement Observation Catalog, 1984 through 1998. Regional Information Report No. 3A99-11. Alaska Department of Fish and Game, Division of Commercial Fisheries, Anchorage.
- Burkey, C. Jr., M. Coffing, D.B. Molyneaux, and P. Salomone. 2000a. Kuskokwim River chinook salmon stock status and development of management/action plan options. Alaska Department of Fish and Game, Commercial Fisheries Division, Regional Information Report 3A00-40, Anchorage.

## LITERATURE CITED (Continued)

- Burkey, C. Jr., M. Coffing, D.B. Molyneaux, and P. Salomone. 2000b. Kuskokwim River chum salmon stock status and development of management/action plan options. Alaska Department of Fish and Game, Commercial Fisheries Division, Regional Information Report 3A00-441, Anchorage.
- Burkey, C. Jr., M. Coffing, J. Estensen, R. L. Fisher, and D.B. Molyneaux. 2002. Annual management report for the subsistence and commercial fisheries of the Kuskokwim Area, 2001. Regional Information Report No. 3A02-53. Alaska Department of Fish and Game, Division of Commercial Fisheries, Anchorage.
- Clutter, R., and L. Whitesel. 1956. Collection and interpretation of sockeye salmon scales. Bulletin of the International North Pacific Fisheries Commission 9.
- Clark, K.J. and D.B. Molyneaux 2003. Takotna river salmon studies and upper Kuskokwim River aerial surveys 2002. Alaska Department of Fish and Game, Commercial Fisheries Division, Regional Information Report No. 3A03-10, Anchorage.
- DuBois, L. and D.B. Molyneaux. 2000. Salmon age, sex and length catalog for the Kuskokwim area, 1999 Progress Report. Alaska Dept. of Fish and Game, Commercial Fisheries Division, Regional Informational Report 3A00-18, Anchorage.
- Groot, C., and L. Margolis, editors. 1991. Pacific salmon life histories. UBC Press, Vancouver, British Columbia.
- International North Pacific Fisheries Commission (INRPC). 1963. Annual Report, 19 Vancouver, British Columbia.
- Morrow, J.E. 1980. The freshwater fishes of Alaska. Alaska Northwest Publishing Company, Anchorage, Alaska.
- Molyneaux, D. and L. DuBois. 1996. Salmon age, sex, and length catalog for the Kuskokwim area, 1971-1995. Regional Information Report No. 3A96-31. Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division, Anchorage.
- Sandercock, F. K. 1991. Life history of coho salmon (*Oncorhynchus kisutch*). Pages 395-446 in C Groot and L Margolis, editors. Pacific salmon life histories. University of British Columbia Press, Vancouver, British Columbia, Canada.
- Schoder, S.L. 1982 The influence of intrasexual competition on the distribution of chum salmon in an experimental stream, p 275-285. In: E.L. Brannon and E.O. Salo (eds.) Proceedings of the Salmon and Trout Migratory Behavior Symposium. School of Fisheries, University of Washington, Seattle.
- Schneiderhan, D.J., editor. 1983. Kuskokwim stream catalog, 1954-1983. Alaska Department of Fish and Game, Division of Commercial Fisheries, Anchorage.

#### LITERATURE CITED (Continued)

- Schneiderhan, D.J. 1989. Kogrukuk weir salmon escapement study, 1988. Regional Information Report No. 3A89-09. Alaska Department of Fish and Game, Division of Commercial Fisheries, Anchorage.
- Wood, C.C., B.E. Riddell, and D.T. Rutherford. 1987. Alternative juvenile life histories of sockeye salmon (*Oncorhynchus nerka*) and their contribution to production in the Stikine River, Northern British Columbia. Pages 12-24.

## **Tables**

Table 1. Actual daily and estimated totals of chinook, sockeye, chum and coho salmon at the Kogrukuk River weir, 2002.

Date	Chinook				Chum				Sockeye			Coho		
	Male	Jacks <sup>a</sup>	Female	Totals	Male	Female	Totals	Male	Female	Totals	Male	Female	Totals	
.6/21				0			0			0				
6/22				0			0			0				
6/23				0			0			0				
6/24				0			0			0				
6/25				0			0			0				
6/26	11	4	4	15	187	60	247	3	0	3				
6/27	99	21	44	143	501	129	630	4	1	5				
6/28	65	16	38	103	387	87	474	1	0	1				
6/29	205	37	74	279	811	162	973	10	7	17				
6/30	67	18	22	89	908	173	1,081	3	3	6				
7/1	146	14	41	187	903	142	1,045	8	8	16				
7/2	236	20	74	310	747	186	933	55	22	77				
7/3	105	11	24	129	912	199	1,111	85	60	145				
7/4	486	88	132	618	1,547	380	1,927	134	101	235				
7/5	80	5	10	90	1,398	307	1,705	65	93	158				
7/6	885	104	307	1,192	1,896	493	2,389	186	236	422				
7/7	93	26	30	123	1,751	515	2,266	29	14	43				
7/8	577	94	149	726	1,760	516	2,276	263	228	491				
7/9	193	43	48	241	1,828	545	2,373	25	26	51				
7/10	345	34	105	450	2,495	648	3,143	105	85	190				
7/11	635	124	169	804	2,573	829	3,402	262	159	421				
7/12	429	82	118	547	2,277	779	3,056	170	105	275				
7/13	346	84	96	442	1,782	555	2,337	102	25	127				
7/14	303	85	99	402	1,705	389	2,094	144	61	205				
7/15	265	49	116	381	1,815	339	2,154	88	69	157				
7/16	209	23	106	315	1,783	392	2,175	126	85	211				
7/17	195	36	135	330	503	162	665	151	71	222				
7/18 <sup>b</sup>	73	4	39	112	457	162	619	56	26	82				
7/19	183	21	106	289	809	199	1,008	52	15	67				
7/20 <sup>b</sup>	105	15	50	155	462	86	548	29	8	37				
7/21 <sup>b</sup>	70	13	23	93	292	38	330	6	4	10				
7/22	160	28	89	249	987	211	1,198	22	9	31	0	1	1	
7/23	74	10	40	114	989	163	1,152	9	8	17	0	0	0	
7/24	115	23	61	176	2,453	460	2,913	34	25	59	3	2	5	
7/25	85	19	46	131	915	223	1,138	26	7	33	3	5	8	
7/26	49	13	33	82	457	99	556	18	6	24	2	0	2	
7/27	30	1	20	50	377	91	468	8	1	9	3	2	5	
7/28	18	7	19	37	190	70	260	13	0	13	2	1	3	
7/29	21	5	11	32	210	42	252	5	1	6	0	0	0	
7/30	17	1	14	31	122	27	149	6	0	6	0	0	0	
7/31	2	1	6	8	91	15	106	4	2	6	0	0	0	
8/1	16	4	7	23	55	18	73	0	0	0	0	0	0	
8/2	9	2	3	12	48	7	55	1	0	1	1	2	3	
8/3 <sup>b</sup>	2	0	0	2	13	2	15	1	0	1	0	0	0	
8/4 <sup>b</sup>	2	0	0	2	2	-2	0	0	0	0	0	0	0	
8/5 <sup>b</sup>	2	1	1	3	11	4	15	1	0	1	2	1	3	
8/6	6	4	3	9	12	9	21	1	0	1	5	3	8	
8/7	6	2	0	6	11	3	14	2	0	2	5	1	6	
8/8	9	3	2	11	10	8	18	2	1	3	12	8	20	
8/9	5	1	2	7	9	6	15	2	0	2	10	2	12	
8/10	1	0	0	1	5	3	8	3	1	4	5	3	8	
8/11	3	0	2	5	1	4	5	0	0	0	4	1	5	
8/12	2	0	3	5	9	9	18	1	2	3	36	14	50	

-Continued-

Table I. (page 2 of 2)

Date	Chinook				Chum			Sockeye			Coho		
	Male	Jacks <sup>a</sup>	Female	Totals	Male	Female	Totals	Male	Female	Totals	Male	Female	Totals
8/13	2	0	1	3	14	11	25	0	0	0	34	25	59
8/14	3	3	1	4	3	3	6	0	0	0	12	19	31
8/15	1	0	1	2	4	1	5	2	0	2	37	19	56
8/16	1	0	0	1	4	0	4	0	1	1	58	31	89
8/17	0	0	0	0	1	1	2	0	0	0	50	23	73
8/18	0	0	0	0	2	1	3	1	1	2	37	11	48
8/19	0	0	0	0	1	0	1	0	0	0	12	5	17
8/20	0	0	0	0	0	0	0	1	-1	0	87	38	125
8/21	1	0	0	1	3	3	6	1	2	3	543	200	743
8/22	2	0	0	2	4	1	5	0	0	0	562	263	825
8/23	3	0	0	3	2	1	3	1	2	3	705	253	958
8/24	1	0	0	1	3	0	3	1	0	1	589	225	814
8/25	2	0	0	2	1	2	3	0	0	0	717	363	1,080
8/26	0	0	0	0	1	0	1	0	0	0	171	72	243
8/27	1	0	0	1	0	0	0	0	0	0	212	89	301
8/28	3	0	0	3	1	0	1	2	1	3	257	84	341
8/29	1	1	0	1	1	0	1	0	0	0	219	89	308
8/30	2	0	0	2	1	0	1	0	0	0	434	168	602
8/31	1	0	0	1	1	0	1	0	0	0	890	460	1,350
9/1	0	0	0	0	0	0	0	0	0	0	671	334	1,005
9/2	2	0	0	2	1	0	1	0	0	0	360	149	509
9/3	0	0	0	0	2	0	2	1	0	1	224	127	351
9/4	0	0	0	0	1	0	1	0	0	0	330	170	500
9/5	0	0	0	0	0	0	0	0	0	0	519	341	860
9/6	0	0	0	0	0	0	0	0	0	0	400	347	747
9/7	0	0	0	0	0	1	1	1	0	1	279	316	595
9/8	0	0	0	0	1	1	2	0	0	0	206	167	373
9/9	0	0	0	0	0	0	0	0	0	0	70	77	147
9/10	0	0	0	0	0	0	0	0	0	0	74	80	154
9/11	0	0	0	0	0	0	0	0	0	0	58	35	93
9/12	0	0	0	0	1	0	1	0	0	0	155	78	233
9/13	0	0	0	0	1	0	1	0	0	0	112	96	208
9/14	0	0	0	0	1	0	1	0	0	0	59	38	97
9/15	0	0	0	0	2	0	2	0	0	0	59	51	110
9/16	0	0	0	0	0	0	0	0	0	0	32	39	71
9/17	0	0	0	0	0	0	0	0	0	0	31	22	53
9/18	0	0	0	0	0	0	0	0	0	0	25	10	35
9/19	0	0	0	0	0	0	0	0	0	0	20	22	42
9/20	0	0	0	0	0	0	0	0	0	0	18	11	29
9/21	0	0	0	0	0	0	0	0	0	0	14	9	23
9/22	0	0	0	0	0	0	0	0	0	0	12	4	16
9/23	0	0	0	0	0	0	0	0	0	0	8	5	13
9/24	0	0	0	0	1	0	1	0	0	0	26	9	35
9/25	0	0	0	0	0	0	0	0	0	0	0	0	0
Totals	7,066	1,200	2,524	9,590	39,524	9,970	49,494	2,332	1,581	3,913	9,481	5,020	14,501
Est. Escapement				10,104			51,570			4,050			14,516
% Estimated				5.1%			4.0%			3.4%			0.1%

<sup>a</sup> Chinook jacks included in male totals.

^ Estimates based on expanded partial daily counts.

Table 2. Age and sex of chinook salmon at the Kogrukuk River weir based on escapement samples collected with a fish trap, 2002.

Year	Sample Dates (Stratum Dates)	Sample Size	Sex	Age Class							
				1.1 (Age 3)		1.2 (Age 4)		1.3 (Age 5)		2.2 (Age 5)	
				Esc.	%	Esc.	%	Esc.	%	Esc.	%
2002	6/28, 30 - 7/5 (6/26 - 7/7)	94	M	0	0.0	837.00	25.5	1,514.00	46.8	0	0.0
			F	0	0.0	-	0.0	105.00	3.2	0	0.0
			Subtotal	0	0.0	837.00	25.5	1,619.00	50.0	0	0.0
	7/9 - 12 (7/8 - 14)	191	M	0	0.0	492.00	13.6	1,664.00	46.1	0	0.0
			F	0	0.0	-	0.0	95.00	2.6	0	0.0
			Subtotal	0	0.0	492.00	13.6	1,759.00	48.7	0	0.0
	7/16 - 19 (7/15 - 20)	110	M	0	0.0	258.00	13.6	775.00	40.9	0	0.0
			F	0	0.0	-	0.0	104.00	5.5	0	0.0
			Subtotal	0	0.0	258.00	13.6	879.00	46.4	0	0.0
	7/22 - 26, 29 8/3, 6, 22 (7/21 - 9/24)	71	M	0	0.0	167.00	12.7	648.00	49.3	0	0.0
			F	0	0.0	-	0.0	129.00	9.9	0	0.0
			Subtotal	0	0.0	167.00	12.7	777.00	59.2	0	0.0
Season	466		M	0	0.0	1,754.00	17.4	4,622.00	45.7	0	0.0
			F	0	0.0	-	0.0	432.00	4.3	0	0.0
			Total	0	0.0	1,754.00	17.4	5,054.00	50.0	0	0.0
Historical Total	7,397.00		M	332.74	0.3	19,318.41	16.7	40,305.03	34.9	39.05	0.0
			F	0	0.0	279.63	0.2	6,339.75	5.5	0	0.0
			Total	332.74	0.3	19,598.03	17.0	46,644.78	40.4	39.05	0.0
Year	Sample Dates (Stratum Dates)	Sample Size	Sex	Age Class							
				2.3 (Age 6)		1.5 (Age 7)		2.4 (Age 7)		1.6 (Age 8)	
				Esc.	%	Esc.	%	Esc.	%	Esc.	%
2002	6/28, 30 - 7/5 (6/26 - 7/7)	94	M	0	0.0	0	0.0	0	0.0	0	0.0
			F	0	0.0	0	0.0	0	0.0	0	0.0
			Subtotal	0	0.0	0	0.0	0	0.0	0	0.0
	7/9 - 12 (7/8 - 14)	191	M	0	0.0	19.00	0.5	0	0.0	0	0.0
			F	0	0.0	38.00	1.1	0	0.0	0	0.0
			Subtotal	0	0.0	57.00	1.6	0	0.0	0	0.0
	7/16 - 19 (7/15 - 20)	110	M	0	0.0	34.00	1.8	0	0.0	0	0.0
			F	0	0.0	52.00	2.7	0	0.0	0	0.0
			Subtotal	0	0.0	86.00	4.5	0	0.0	0	0.0
	7/22 - 26, 29 8/3, 6, 22 (7/21 - 9/24)	71	M	0	0.0	0	0.0	0	0.0	0	0.0
			F	0	0.0	0	0.0	0	0.0	0	0.0
			Subtotal	0	0.0	0	0.0	0	0.0	0	0.0
Season	466		M	0	0.0	53.00	0.5	0	0.0	0	0.0
			F	0	0.0	90.00	0.9	0	0.0	0	0.0
			Total	0	0.0	143.00	1.4	0	0.0	0	0.0
Historical Total	7,397.00		M	65.87	0.1	539.27	0.5	12.54	0.0	0	0.0
			F	0	0.0	2,420.79	2.1	0	0.0	8.46	0.0
			Total	65.87	0.1	2,960.07	2.6	12.54	0.0	8.46	0.0

Table 3. Mean length (mm) of chinook salmon at the Kogrukuk River weir based on escapement samples collected with a fish trap, 2002.

Year	Sample Dates (Stratum Dates)	Sex	Age Class								
			1.1 (Age 3)	1.2 (Age 4)	1.3 (Age 5)	2.2 (Age 5)	1.4 (Age 6)	2.3 (Age 6)	1.5 (Age 7)	2.4 (Age 7)	1.6 (Age 8)
2002	6/28, 30 - 7/5 (6/26 - 7/7)	M	Mean Length		562	675		738			
			Std Error		6	8		25			
			Range		515-625	561-818		552-820			
			Sample Size	0	24	44	0	10	0	0	0
	7/9 - 12 (7/8 - 14)	F	Mean Length			782		851			
			Std Error			8		15			
			Range			767-790		762-929			
			Sample Size	0	0	3	0	13	0	0	0
	7/16 - 19 (7/15 - 20)	M	Mean Length		564	682		777		977	
			Std Error		8	6		13			
			Range		478-659	518-818		558-889		977-977	
			Sample Size	0	26	88	0	26	0	1	0
	F		Mean Length			784		855		867	
			Std Error			13		7		44	
			Range			758-821		760-939		823-910	
			Sample Size	0	0	5	0	43	0	2	0
7/22 - 26, 29 8/3, 6, 22 (7/21 - 9/24)	M	M	Mean Length		563	705		834		928	
			Std Error		12	9		24		35	
			Range		455-635	547-840		735-920		893-962	
			Sample Size	0	15	45	0	7	0	2	0
	F		Mean Length			779		869		893	
			Std Error			22		10		21	
			Range			702-871		749-979		854-926	
			Sample Size	0	0	6	0	32	0	3	0
	Season	M	Mean Length		567	688		761			
			Std Error		27	11		30			
			Range		468-771	550-836		646-887			
			Sample Size	0	9	35	0	7	0	0	0
			Mean Length			766		846			
			Std Error			25		11			
			Range			667-880		802-953			
			Sample Size	0	0	7	0	13	0	0	0
Total	M	M	Mean Length	427	569	703	660	824	826	917	775
			Range	355- 639	381- 760	481- 935	550-803	530- 1100	777- 875	786- 1089	775- 775
			Sample Size	12	1,165	2,812	2	1,005	2	59	1
			Mean Length		592	782		867		902	
	F		Range		568- 635	613- 963		695- 1035		740- 1072	
			Sample Size	0	7	322	0	1,792	0	212	0

Table 4. Age and sex of chum salmon at the Kogrukluk River weir based on escapement samples collected with a fish trap, 2002.

Year	Sample Dates (Stratum Dates)	Sample Size	Sex	Age Class								Total	
				0.2 (Age 3)		0.3 (Age 4)		0.4 (Age 5)		0.5 (Age 6)			
				Esc.	%	Esc.	%	Esc.	%	Esc.	%		
2002	6/28 - 29 (6/26 - 7/1)	186	M	0	0.0	1,747	39.2	1,986	44.6	215	4.9	3,948 88.7	
			F	0	0.0	167	3.8	311	7.0	24	0.5	502 11.3	
			Subtotal	0	0.0	1,914	43.0	2,297	51.6	239	5.4	4,450 100.0	
	7/3 - 4 (7/2 - 6)	109	M	0	0.0	4,291	53.2	2,664	33.0	74	0.9	7,029 87.2	
			F	0	0.0	592	7.4	370	4.6	74	0.9	1,036 12.8	
			Subtotal	0	0.0	4,883	60.6	3,034	37.6	148	1.8	8,065 100.0	
	7/8 - 9 (7/7 - 12)	172	M	0	0.0	10,370	62.8	2,977	18.0	96	0.6	13,443 81.4	
			F	0	0.0	2,305	13.9	768	4.7	0	0.0	3,073 18.6	
			Subtotal	0	0.0	12,675	76.7	3,745	22.7	96	0.6	16,516 100.0	
	7/15 - 16 (7/13 - 19)	174	M	0	0.0	8,821	75.3	1,212	10.4	67	0.6	10,100 86.2	
			F	0	0.0	1,414	12.1	202	1.7	0	0.0	1,616 13.8	
			Subtotal	0	0.0	10,235	87.4	1,414	12.1	67	0.6	11,716 100.0	
	7/22 - 23 (7/20 - 26)	176	M	52	0.6	6,768	73.9	1,042	11.3	0	0.0	7,861 85.8	
			F	0	0.0	1,093	11.9	208	2.3	0	0.0	1,302 14.2	
			Subtotal	52	0.6	7,861	85.8	1,250	13.6	0	0.0	9,163 100.0	
	7/29 - 31, 8/6 (7/27 - 9/24)	182	M	9	0.5	1,240	74.7	146	8.8	0	0.0	1,395 84.1	
			F	18	1.1	219	13.2	27	1.6	0	0.0	265 15.9	
			Subtotal	27	1.6	1,459	87.9	173	10.4	0	0.0	1,660 100.0	
	Season	999	M	61	0.1	33,238	64.5	10,025	19.4	453	0.9	43,777 84.9	
			F	18	0.1	5,790	11.2	1,887	3.7	98	0.2	7,793 15.1	
		Total		79	0.2	39,028	75.7	11,912	23.1	551	1.1	51,570 100.0	
Historic Total	10,204	M	2,099	0.4	205,074	40.0	163,610	31.9	4,315	0.8	375,081	73.2	
			1,092	0.2	73,062	14.3	61,976	12.1	1,116	0.2	137,238	26.8	
		Total	3,191	0.6	278,136	54.3	225,586	44.0	5,431	1.1	512,318	100.0	

Table 5. Mean length (mm) of chum salmon at the Kogrukuk River weir based on escapement samples collected with a fish trap, 2002.

Year	Sample Dates (Stratum Dates)	Sex	Age Class			
			0.2 (Age 3)	0.3 (Age 4)	0.4 (Age 5)	0.5 (Age 6)
2002	6/28 6/29 (6/26 - 7/1)	M	Mean Length	593	617	627
			Std. Error	3	3	6
			Range	532- 647	565- 696	603- 657
			Sample Size	0	73	83
	7/3/2004 (7/2 - 6)	F	Mean Length	578	585	608
			Std. Error	10	6	
			Range	540- 625	551- 629	608- 608
			Sample Size	0	7	13
7/8/2009	7/7 - 12	M	Mean Length	586	593	615
			Std. Error	4	5	
			Range	540- 679	524- 690	615- 615
			Sample Size	0	58	36
	7/15/2016 (7/13 - 19)	F	Mean Length	554	582	538
			Std. Error	7	16	
			Range	525- 572	523- 620	538- 538
			Sample Size	0	8	5
7/22/2023	7/20 - 26	M	Mean Length	579	595	584
			Std. Error	3	6	
			Range	518- 685	539- 663	584- 584
			Sample Size	0	108	31
	7/20 - 26	F	Mean Length	554	550	
			Std. Error	6	9	
			Range	490- 607	520- 590	
			Sample Size	0	24	8
						0

-Continued-

Table 5. (Page 2 of 2)

Year	Sample Dates (Stratum Dates)	Sex	Age Class			
			0.2 (Age 3)	0.3 (Age 4)	0.4 (Age 5)	0.5 (Age 6)
2002 (cont.)	7/22/2023 (7/20 - 26)	F	Mean Length	548	537	
			Std. Error	5	23	
			Range	500- 583	499- 603	
			Sample Size	0	21	4
						0
		M	Mean Length	511	569	588
			Std. Error	2	10	
			Range	511- 511	506- 668	530- 677
			Sample Size	1	136	16
						0
		F	Mean Length	523	534	549
			Std. Error	6	5	4
			Range	517- 529	489- 593	542- 553
			Sample Size	2	24	3
						0
	Season	M	Mean Length	548	579	598
			Range	511- 554	501- 685	524- 696
			Sample Size	2	636	204
						12
		F	Mean Length	523	551	560
			Range	517- 529	489- 625	499- 629
			Sample Size	2	105	36
						2
<hr/>						
Historical	Total	M	Mean Length	562	583	604
			Range	470- 654	470- 692	470- 654
			Sample size	58	4810	3013
						90
		F	Mean Length	541	561	578
			Range	470- 654	470- 654	470- 654
			Sample size	26	1281	888
						30

Table 6. Age and sex of coho salmon at the Kogrukuk River weir based on escapement samples collected with a fish trap, 2002.

Year	Sample Dates (Stratum Dates)	Sample Size	Sex	Age Class								Total	
				1.1 (Age 3)		2.1 (Age 4)		2.2 (Age 5)		3.1 (Age 5)			
				Esc.	%	Esc.	%	Esc.	%	Esc.	%		
2002	8/6, 22 - 25 (6/16 - 8/28)	160	M	0	0.0	3,724	62.5	0	0.0	447	7.5	4,171	70.0
			F	0	0.0	1,601	26.9	0	0.0	186	3.1	1,787	30.0
			Subtotal	0	0.0	5,325	89.4	0	0.0	633	10.6	5,958	100.0
	9/1 - 3 (8/29 - 9/6)	149	M	0	0.0	3,555	57.0	0	0.0	878	14.1	4,434	71.1
			F	0	0.0	1,508	24.2	0	0.0	293	4.7	1,798	28.9
			Subtotal	0	0.0	5,061	81.2	0	0.0	1,171	16.8	6,232	100.0
	9/10 - 14 (9/7 - 9/24)	114	M	0	0.0	1,286	55.3	0	0.0	143	6.1	1,429	61.4
			F	0	0.0	878	37.7	0	0.0	20	0.9	898	38.6
			Subtotal	0	0.0	2,164	93.0	0	0.0	163	7.0	2,327	100.0
Season	423	M	0	0.0	8,565	59.0	0	0.0	1,468	10.1	10,033	69.1	
		F	0	0.0	3,985	27.4	0	0.0	499	3.5	4,484	30.9	
		Total	0	0.0	12,550	86.4	0	0.0	1,967	13.6	14,517	100.0	
Historic	4,487	M	3,647	1.6	128,633	57.1	6	0.0	7,155	3.2	139,558	61.9	
		F	1,534	0.7	79,297	35.2	0	0.0	4,887	2.2	85,746	38.1	
		Total	5,181	2.3	207,930	92.3	6	0.0	12,042	5.3	225,300	100.0	

Table 7. Mean length (mm) of coho salmon at the Kogruklu River weir based on escapement samples collected with a fish trap, 2002.

Year	Sample Dates (Stratum Dates)	Sex	Age Class			
			1.1 (Age 3)	2.1 (Age 4)	2.2 (Age 5)	3.1 (Age 5)
2002	8/6, 22 - 25 (6/16 - 8/28)	M	Mean Length	546		556
			Std. Error	3		8
			Range	456- 637		502- 594
	9/1 - 3 (8/29 - 9/6)	F	Sample Size	0	100	0
			Mean Length	559		580
			Std. Error	4		7
	9/10 - 14 (9/7 - 9/24)	M	Range	492- 602		554- 594
			Sample Size	0	43	0
			Mean Length	564		580
Season	M		Std. Error	4		7
			Range	480- 614		511- 621
			Sample Size	0	85	0
	F		Mean Length	566		576
			Std. Error	4		7
			Range	529- 619		552- 600
	M		Sample Size	0	36	0
			Mean Length	567		563
			Std. Error	4		8
Historical	Total		Range	495- 654		547- 600
			Sample Size	0	63	0
			Mean Length	568		579
	F		Std. Error	4		
			Range	500- 630		579- 579
			Sample Size	0	43	0
	M		Mean Length	557		571
			Range	456- 654		502- 621
			Sample Size	0	248	0
	F		Mean Length	564		578
			Range	492- 630		552- 600
			Sample Size	0	122	0
	M		Mean Length	559	568	555
			Range	495- 670	435- 695	555- 555
			Sample Size	107	2,680	1
	F		Mean Length	572	570	573
			Range	490- 610	465- 665	500- 650
			Sample size	26	1,467	0
						103

Table 8. Historic salmon escapements for selected tributaries of the Kuskokwim River.

		Chinook Salmon						
Escapement Project		Year						
		1996	1997	1998	1999	2000	2001	2002
Weir		1996	1997	1998	1999	2000	2001	2002
Takotna River		401	1,176			345	723	316
Tatlawiksuk River				970	1,490	817	2,010	2,237
Kogrukluuk River		14,199	13,286	12,107	5,570	3,310	9,298	10,104
George River		7,716	7,834		3,548	2,960	3,309	2,444
Kwethluk River				10,395		3,547		8,397
<b>Aerial Survey</b>								
Salmon River (Pitka Fork)						374	1,029	1,276
Cheenectnuk River			345					730
Holitna River			2,093		741	501	1,760	1,741
Oskawalik River			1,470		98	62	181	235
Holokuk River		85	165		18	42	52	513
Salmon River (Aniak River)		983	980			152	703	1,236
Kipchuk River (Aniak River)			855	443		182		1,615
Aniak River		3,496	2,187	1,930		714		1,856
Kisaralik River			439	457				2,285
		Chum Salmon						
Escapement Project		Year						
Weir		1996	1997	1998	1999	2000	2001	2002
Takotna River		2,808	1,785			1,254	5,420	4,386
Tatlawiksuk River				5,726	9,599	7,044	23,718	24,542
Kogrukluuk River		48,495	7,958	36,442	13,820	11,491	30,570	51,570
George River		21,670	5,907		11,558	3,492	11,601	6,543
Kwethluk River		26,049	10,659			11,691		35,854
<b>Sonar</b>								
Aniak River		302,106	262,522	279,431	105,196	144,157	222,231	363,585
		Coho Salmon						
Escapement Project		Year						
Weir		1996	1997	1998	1999	2000	2001	2002
Takotna River						3,957	2,606	3,984
Tatlawiksuk River					3,455	5,756	10,539	11,363
Kogrukluuk River		50,555	12,237	24,348	12,609	12,237	33,135	14,516
George River			9,210		8,930	11,262	14,415	6,759
Kwethluk River						25,610	22,904	14,516

Table 9. Daily mortality counts for chinook, sockeye, and chum salmon at the Kogrukuk River weir, 2002.

Date	Chinook	Sockeye	Chum	Date	Chinook	Sockeye	Chum
6/26	0	0	1	8/11	38	34	106
6/27	0	0	0	8/12	27	32	82
6/28	0	0	2	8/13	24	52	124
6/29	0	0	7	8/14	42	38	92
6/30	0	0	18	8/15	24	35	81
7/1				8/16			
7/2				8/17	26	48	112
7/3	0	0	32	8/18	7	38	76
7/4	0	0	13	8/19			
7/5	0	0	31	8/20	4	37	49
7/6	0	2	37	8/21	5	28	44
7/7	1	1	41	8/22			
7/8	0	0	80	8/23	4	44	64
7/9	0	1	103	8/24	9	24	30
7/10	0	0	135	8/25	2	12	19
7/11	0	0	230	8/26	2	18	12
7/12	0	0	199	8/27			
7/13	1	0	379	8/28	3	17	12
7/14	0	0	330	8/29			
7/15	0	0	296	8/30			
7/16	1	0	419	8/31	1	26	17
7/17	0	0	551	9/1	2	5	2
7/18	1	0	760	9/2			
7/19	2	0	796	9/3			
7/20	1	0	655	9/4			
7/21	3	0	596	9/5			
7/22	5	0	463	9/6			
7/23	8	1	817	9/7	2	21	4
7/24	8	0	722	9/8			
7/25	38	0	941	9/9			
7/26	25	0	710	9/10	2	1	2
7/27	60	0	623	9/11			
7/28	79	0	1089	9/12			
7/29	106	0	823	9/13	3	1	0
7/30	152	1	727	9/14	0	0	0
7/31	154	4	777	9/15	0	1	1
8/1	159	0	845	9/16			
8/2	109	2	679	9/17	0	0	3
8/3				9/18			
8/4				9/19			
8/5	130	7	600	9/20			
8/6	81	8	202	9/21			
8/7	94	17	322	9/22			
8/8	64	15	202	9/23	0	0	0
8/9	71	28	146	9/24			
8/10	54	12	131	9/25			
				Total	1634	611	17462

## **Figures**



Figure 1. Kuskokwim Area salmon management districts and escapement monitoring projects.

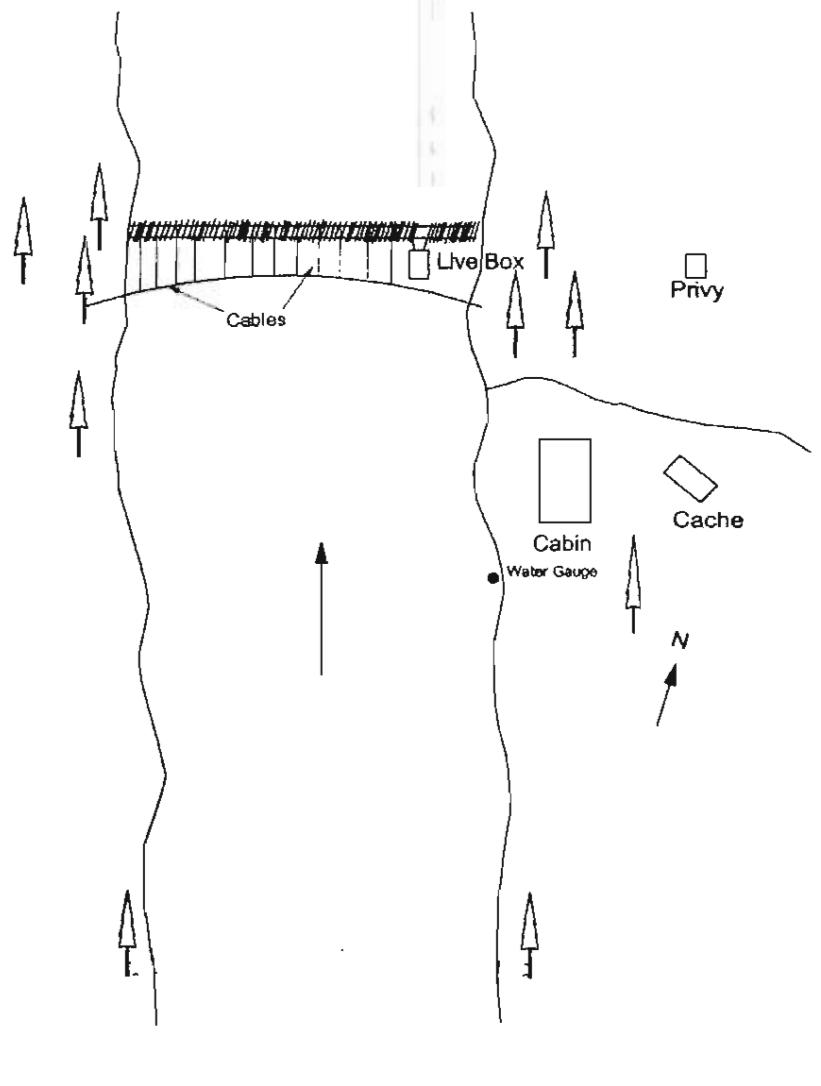


Figure 2. Schematic of the Kogrukluq weir and camp site.

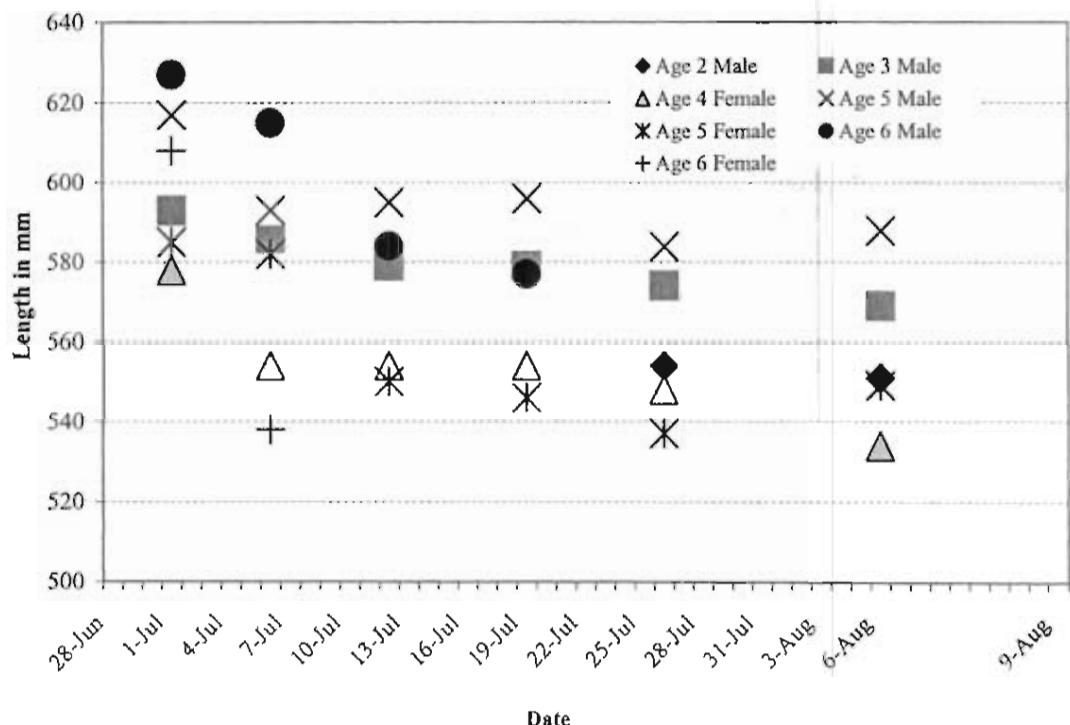


Figure 3. Mean length by date, age and sex for trap caught chum salmon at the Kogruklu River weir, 2002.

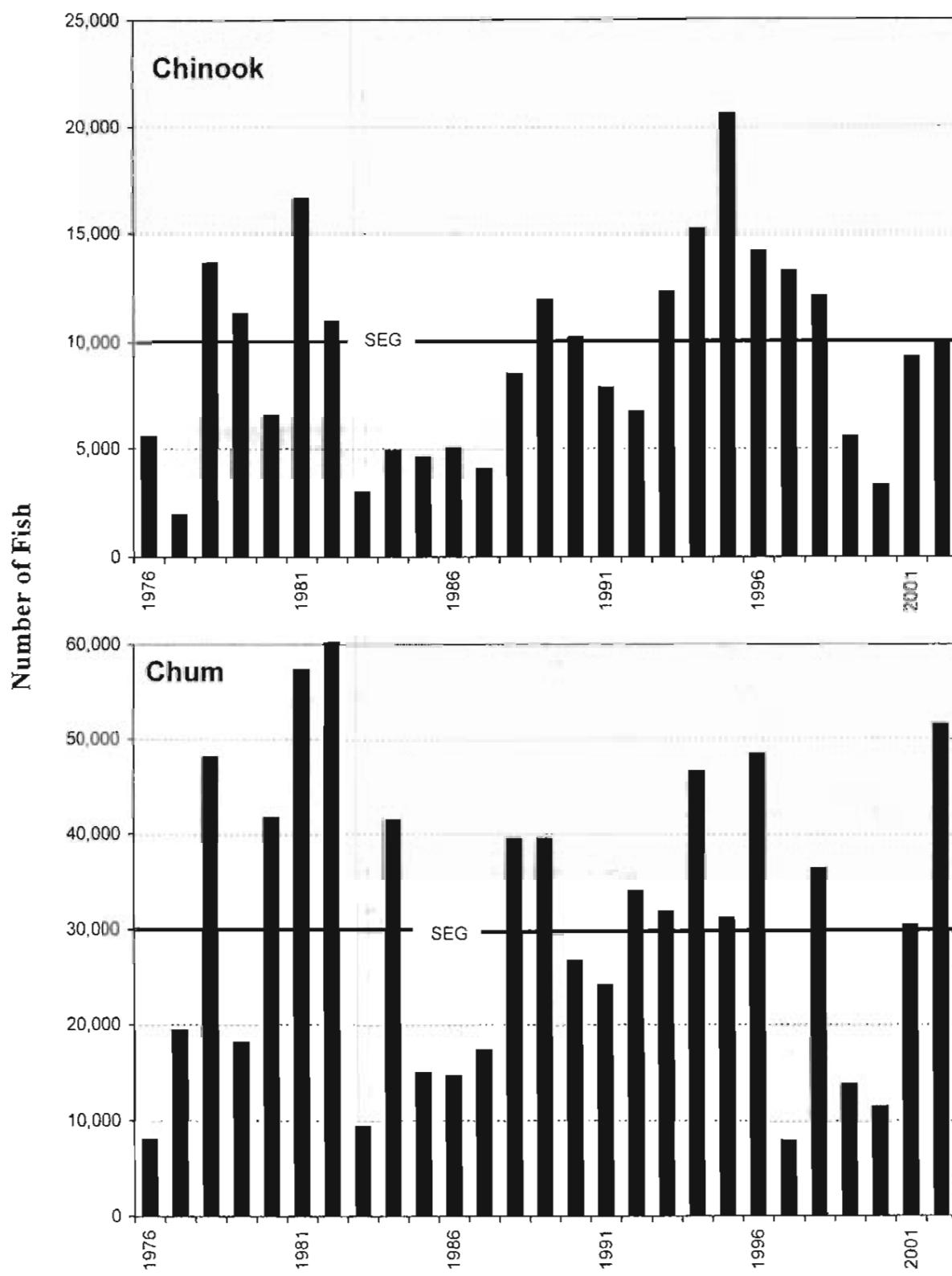


Figure 4. Historical chinook and chum salmon escapement with sustainable escapement goal (SEG) at the Kogrukuk River weir.

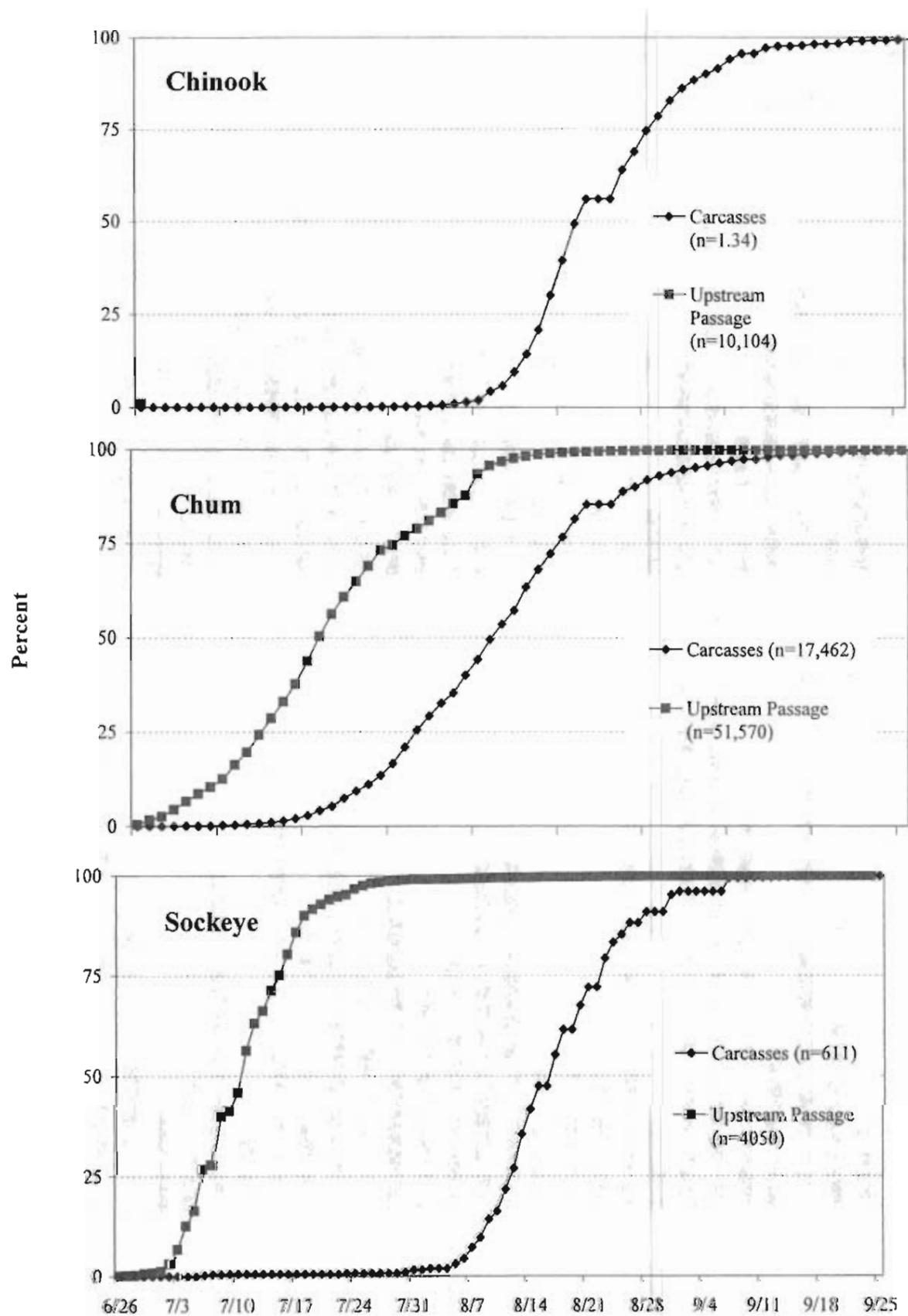


Figure 5. Cumulative upstream passage (%) and downstream carcass passage (%) by species at the Kogruklu River weir, 2002.

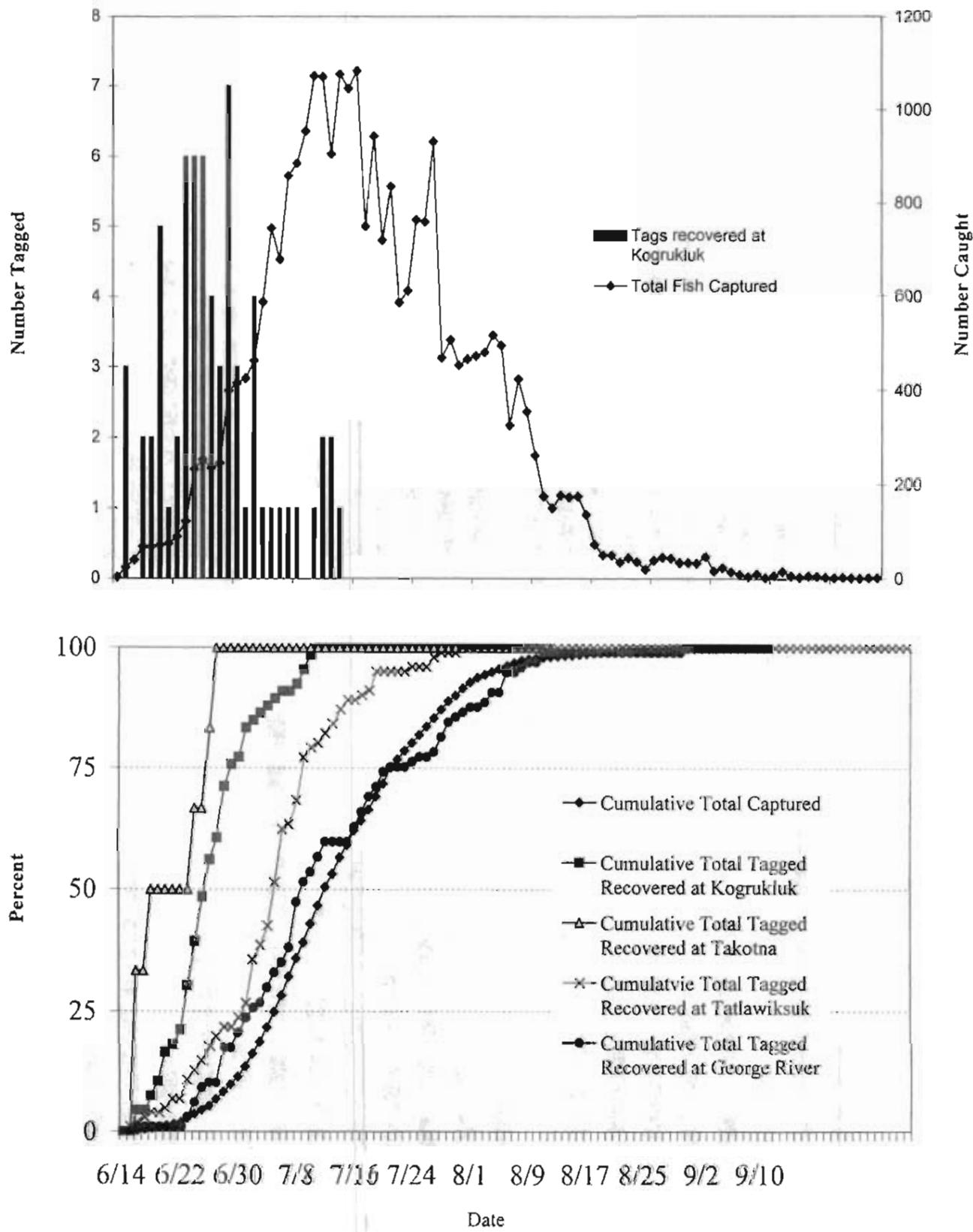


Figure 6. Chum salmon captured at Kalskag and Aniak, by date, compared to chum salmon recovered at the Kogrukuk River weir, by date tagged, 2002.

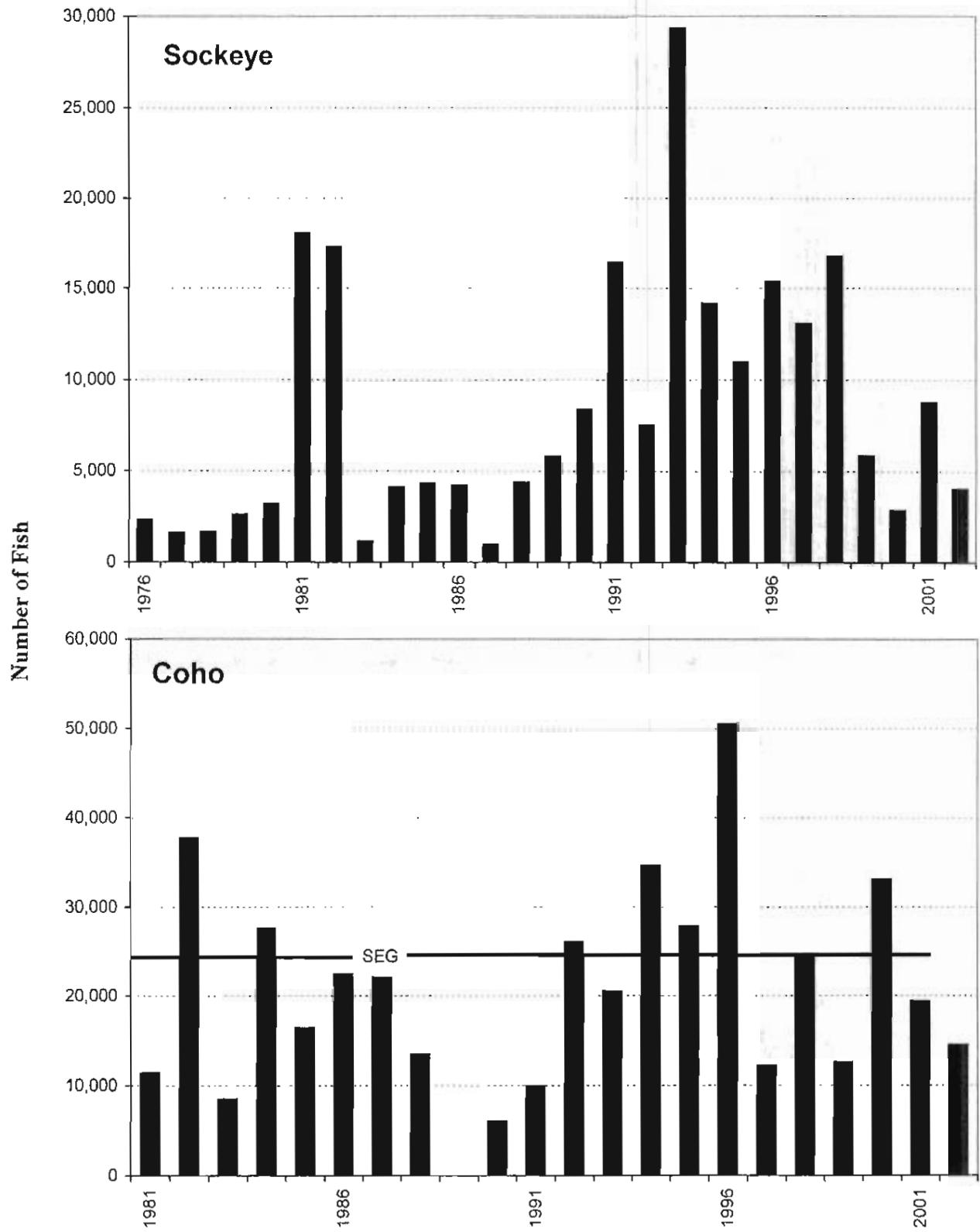


Figure 7. Historical sockeye and coho salmon escapement with sustainable escapement goal (SEG) at the Kogrukuk River weir.

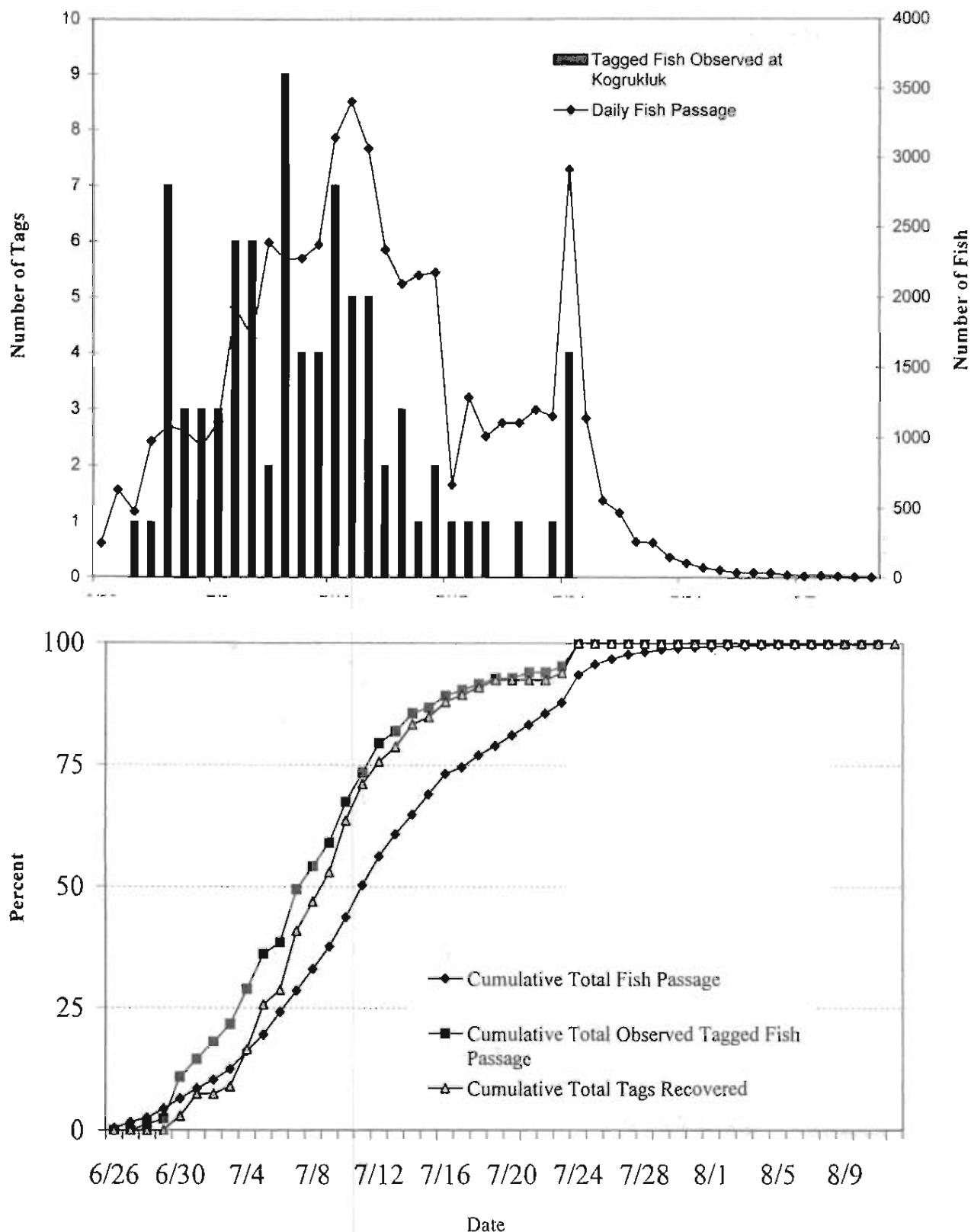


Figure 8. Observed and recaptured tagged chum salmon compared to daily and cumulative percent passage at the Kogrukuk River, 2002.

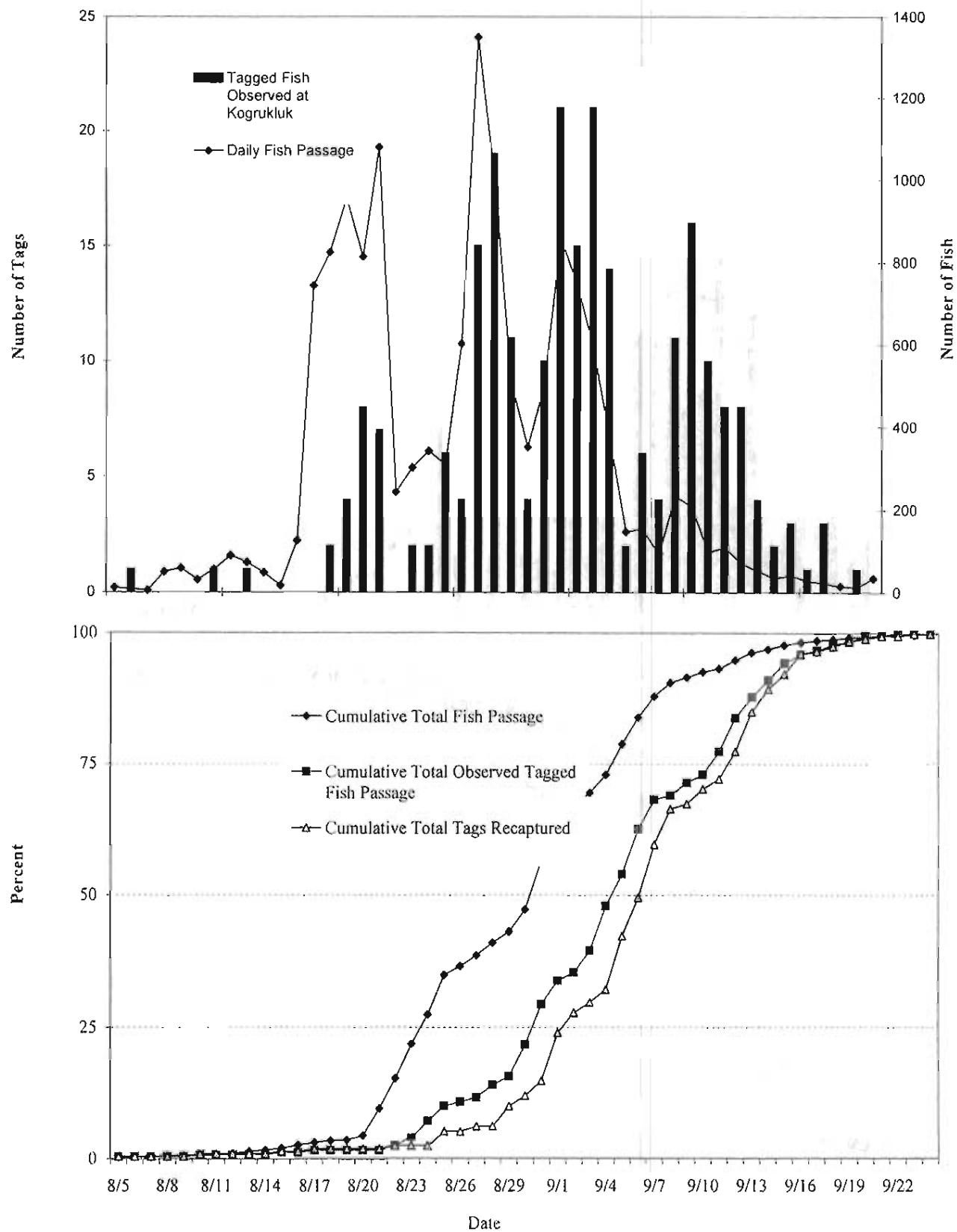


Figure 9. Observed and recaptured tagged coho salmon compared to daily and cumulative percent passage at the Kogrukuk River, 2002.

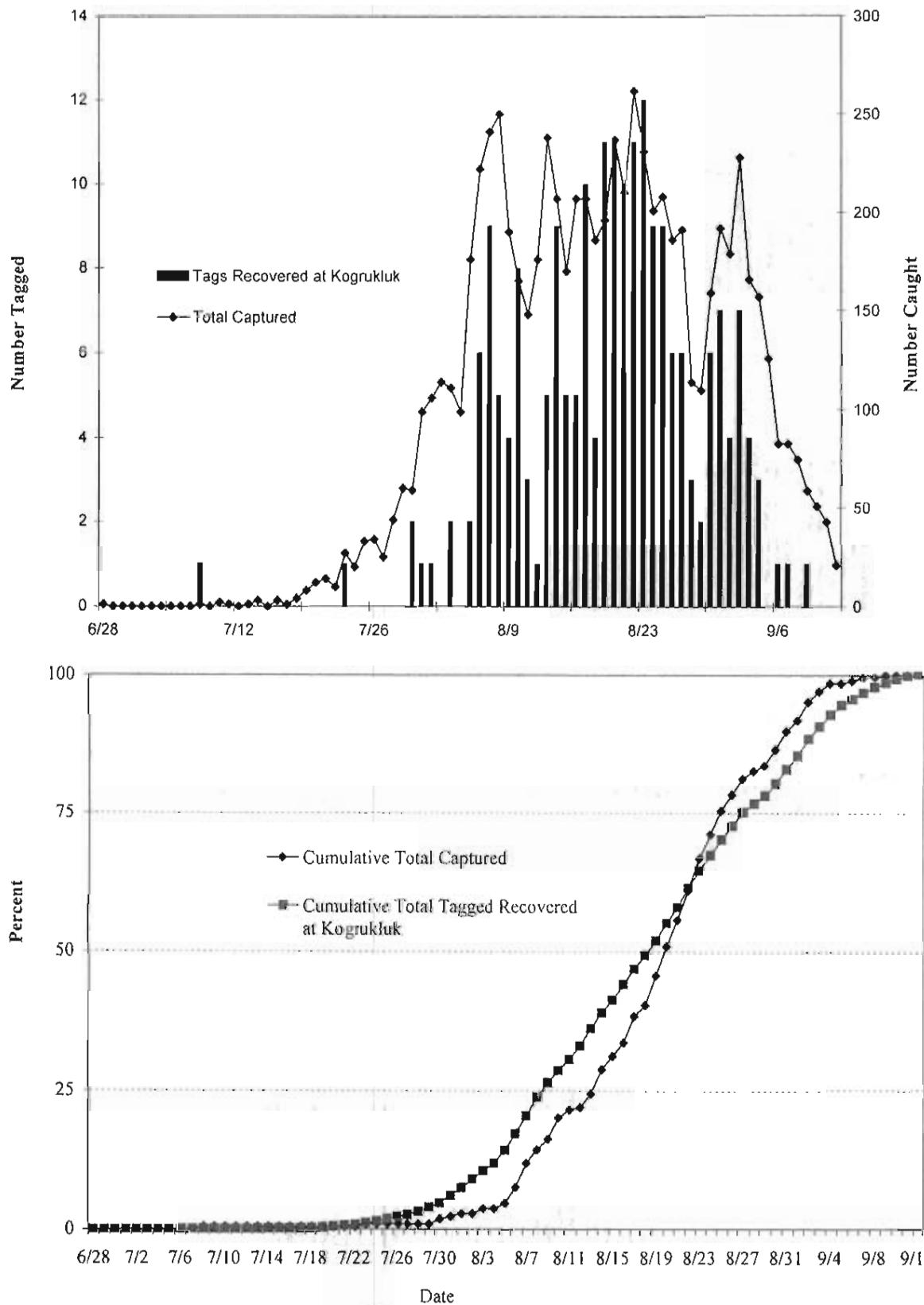


Figure 10. Coho salmon captured at Kalskag and Aniak, by date, compared to coho salmon recovered at the Kogrukuk River weir, by date tagged, 2002.

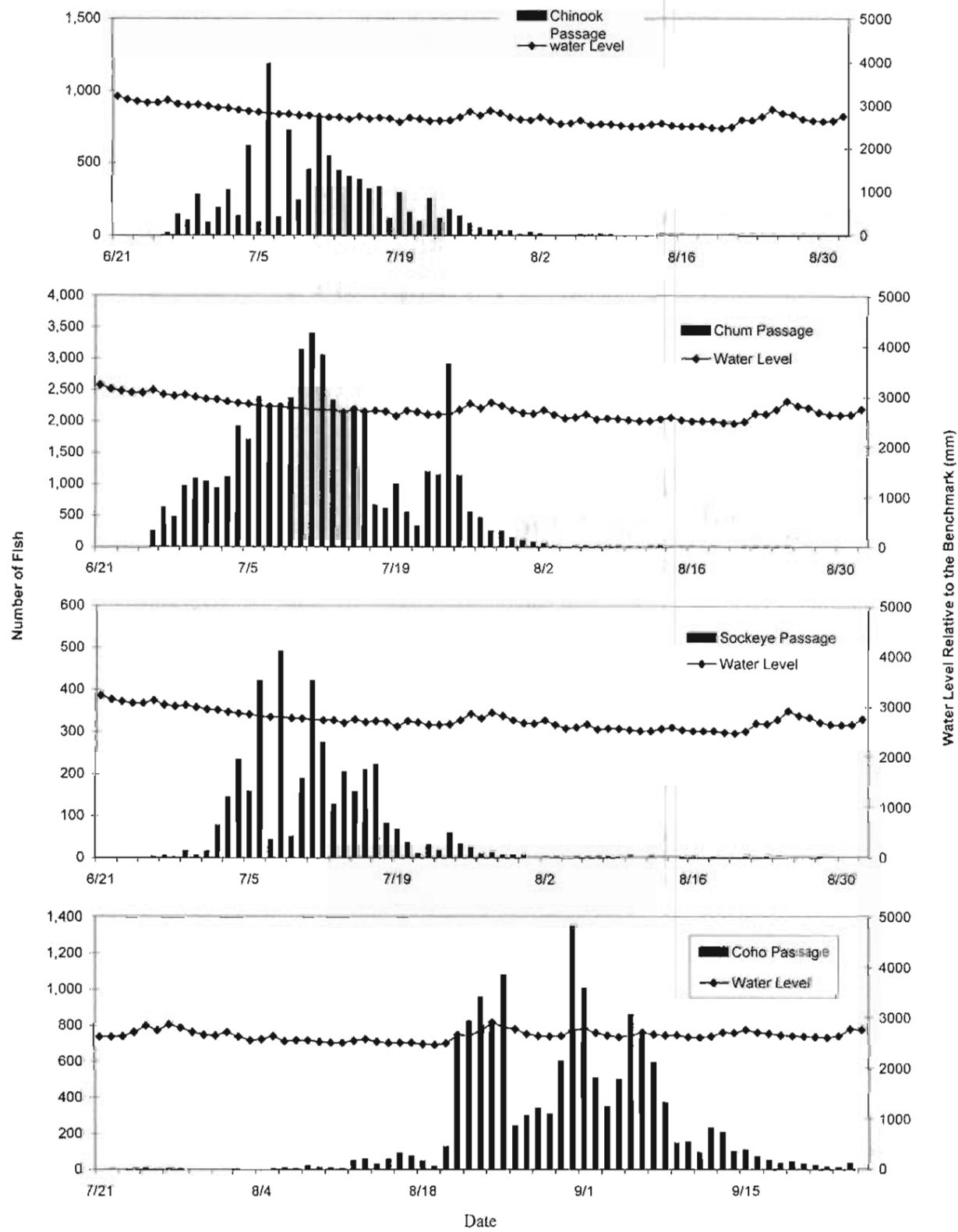


Figure 11. Daily chinook, chum, sockeye and coho salmon passage at the Kogrukuk River weir relative to water level, 2002.

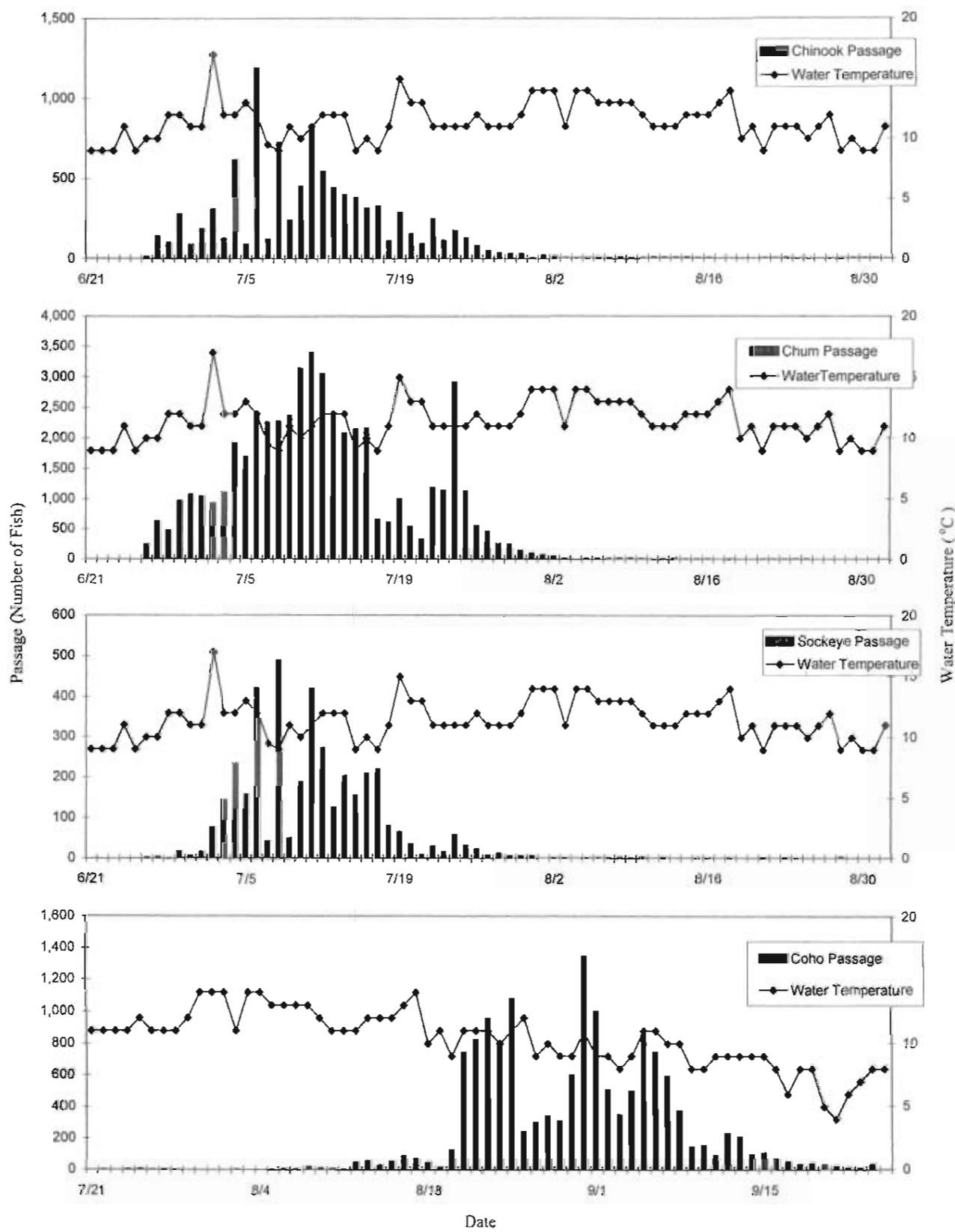


Figure 12. Daily chinook, chum, sockeye and coho salmon passage at the Kogrukluk River weir relative to daily water temperature, 2002.

**APPENDIX A**  
**INFORMATIONAL SUMMARY FROM RECOVERED TAGGED SALMON**

Appendix A.1. Information summary for recovered tagged chum salmon at the Kogrukluk River weir, 2002.

Tagged	Date Recovered	Species	Tag Information		Tagging Location	Tagging Gear	Travel in Days	Travel in Miles/Day
			Tag No.	Tag Color				
6/20	7/4	chum	9014	Pink	Kalskag	Wheel	14	20
6/20	7/5	chum	9012	Pink	Kalskag	Wheel	15	19
6/23	7/7	chum	9134	Pink	Kalskag	Wheel	14	20
6/24	7/7	chum	9158	Pink	Kalskag	Wheel	13	22
6/26	7/8	chum	9171	Pink	Kalskag	Wheel	12	23
6/28	7/8	chum	9426	Pink	Kalskag	Wheel	10	28
6/24	7/9	chum	9163	Pink	Kalskag	Wheel	15	19
6/28	7/9	chum	9420	Pink	Kalskag	Wheel	11	26
6/29	7/10	chum	9501	Pink	Kalskag	Wheel	11	26
7/1	7/13	chum	9696	Pink	Kalskag	Wheel	12	23
6/27	7/14	chum	9372	Pink	Kalskag	Wheel	17	17
6/29	7/14	chum	9481	Pink	Kalskag	Wheel	15	19
7/4	7/16	chum	10208	Pink	Kalskag	Wheel	12	23
7/11	7/23	chum	12445	Pink	Kalskag	Wheel	12	23
7/10	7/24	chum	11932	Pink	Kalskag	Wheel	14	20
7/10	7/24	chum	12209	Pink	Kalskag	Wheel	14	20
					Average		13	22
6/16	6/30	chum	15069	Green	Birch Tree	Wheel	14	19
6/18	6/30	chum	15169	Green	Birch Tree	Wheel	12	22
6/16	7/1	chum	15043	Green	Birch Tree	Wheel	15	18
6/19	7/1	chum	15222	Green	Birch Tree	Wheel	12	22
6/20	7/1	chum	15290	Green	Birch Tree	Wheel	11	24
6/20	7/3	chum	15259	Green	Birch Tree	Wheel	13	20
6/18	7/4	chum	15154	Green	Birch Tree	Wheel	16	17
6/19	7/4	chum	15256	Green	Birch Tree	Wheel	15	18
6/22	7/4	chum	15383	Green	Birch Tree	Wheel	12	22
6/23	7/4	chum	15483	Green	Birch Tree	Wheel	11	24
6/16	7/5	chum	15062	Green	Birch Tree	Wheel	19	14
6/21	7/5	chum	15322	Green	Birch Tree	Wheel	14	19
6/22	7/5	chum	15394	Green	Birch Tree	Wheel	13	20
6/23	7/5	chum	15509	Green	Birch Tree	Wheel	12	22
6/24	7/5	chum	15610	Green	Birch Tree	Wheel	11	24
6/24	7/6	chum	15662	Green	Birch Tree	Wheel	12	22
6/26	7/6	chum	15952	Green	Birch Tree	Wheel	10	26
6/20	7/7	chum	15282	Green	Birch Tree	Wheel	17	16
6/23	7/7	chum	15544	Green	Birch Tree	Wheel	14	19
6/24	7/7	chum	15740	Green	Birch Tree	Wheel	13	20
6/25	7/7	chum	15933	Green	Birch Tree	Wheel	12	22
6/25	7/7	chum	15934	Green	Birch Tree	Wheel	12	22
6/28	7/7	chum	16543	Green	Birch Tree	Wheel	9	29
6/26	7/8	chum	15991	Green	Birch Tree	Wheel	12	22
6/28	7/8	chum	16682	Green	Birch Tree	Wheel	10	26
6/25	7/9	chum	15869	Green	Birch Tree	Wheel	14	19
6/27	7/9	chum	16352	Green	Birch Tree	Wheel	12	22
6/23	7/10	chum	15513	Green	Birch Tree	Wheel	17	16
6/26	7/10	chum	16060	Green	Birch Tree	Wheel	14	19
6/28	7/10	chum	16458	Green	Birch Tree	Wheel	12	22
6/28	7/10	chum	16615	Green	Birch Tree	Wheel	12	22
6/28	7/10	chum	16624	Green	Birch Tree	Wheel	12	22

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Appendix A.1. (Page 2 of 2).

Tagged	Date Tagged	Species	Tag Information		Tagging Location	Tagging Gear	Travel in Days	Travel in Miles/Day
	Recovered		Tag No.	Tag Color				
	6/29	chum	16827	Green	Birch Tree	Wheel	11	24
	6/24	chum	15729	Green	Birch Tree	Wheel	17	16
	6/25	chum	15814	Green	Birch Tree	Wheel	16	17
	6/25	chum	15864	Green	Birch Tree	Wheel	16	17
	6/25	chum	15900	Green	Birch Tree	Wheel	16	17
	6/27	chum	16255	Green	Birch Tree	Wheel	14	19
	6/26	chum	16101	Green	Birch Tree	Wheel	16	17
	7/1	chum	17499	Green	Birch Tree	Wheel	11	24
	7/1	chum	17503	Green	Birch Tree	Wheel	11	24
	7/1	chum	17514	Green	Birch Tree	Wheel	12	22
	6/30	chum	17060	Green	Birch Tree	Wheel	14	19
	7/2	chum	17967	Green	Birch Tree	Wheel	13	20
	7/5	chum	13083	White	Birch Tree	Wheel	11	24
	7/6	chum	13378	White	Birch Tree	Wheel	11	24
	7/3	chum	18103	Green	Birch Tree	Wheel	15	18
	7/8	chum	14577	White	Birch Tree	Wheel	11	24
	7/9	chum	14832	White	Birch Tree	Wheel	15	18
	7/9	chum	14875	White	Birch Tree	Wheel	15	18
							Average	13
								21

Appendix A.2. Information summary for recovered tagged coho salmon at the Kogrukuk River weir, 2002.

Tagged	Date Recovered	Species	Tag Information		Tagging Location	Tagging Gear	Travel in Days	Travel in Miles/Day
			Tag No.	Tag Color				
7/8	7/24	Coho	11362	Pink	Kalskag	Wheel	16	18
7/23	8/10	Coho	4608	Orange	Kalskag	Wheel	17	17
7/31	8/15	Coho	19925	Blue	Kalskag	Wheel	15	19
7/30	8/17	Coho	19822	Blue	Kalskag	Wheel	17	17
8/6	8/25	Coho	29643	Pink	Kalskag	Wheel	19	15
8/8	8/25	Coho	29726	Pink	Kalskag	Wheel	17	17
8/9	8/27	Coho	29846	Pink	Kalskag	Wheel	18	16
8/7	8/29	Coho	29243	Pink	Kalskag	Wheel	22	13
8/6	8/29	Coho	29631	Pink	Kalskag	Wheel	23	12
8/8	8/29	Coho	29766	Pink	Kalskag	Wheel	21	13
8/9	8/29	Coho	29908	Pink	Kalskag	Wheel	20	14
8/13	8/29	Coho	30073	Pink	Kalskag	Wheel	16	18
8/5	8/30	Coho	20066	Pink	Kalskag	Drift	25	11
8/9	8/30	Coho	29888	Pink	Kalskag	Wheel	21	13
8/11	8/31	Coho	29943	Pink	Kalskag	Wheel	20	14
8/14	8/31	Coho	31066	Pink	Kalskag	Wheel	17	17
8/7	9/1	Coho	20119	Blue	Kalskag	Drift	24	12
8/8	9/1	Coho	29715	Green	Kalskag	Wheel	23	12
8/14	9/1	Coho	31047	Pink	Kalskag	Wheel	17	17
8/15	9/2	Coho	20236	Blue	Kalskag	Drift	17	17
8/13	9/2	Coho	30092	Pink	Kalskag	Wheel	19	15
8/17	9/2	Coho	31180	Pink	Kalskag	Wheel	15	19
8/13	9/3	Coho	30059	Pink	Kalskag	Wheel	20	14
8/14	9/3	Coho	31033	Pink	Kalskag	Wheel	19	15
8/20	9/3	Coho	31294	Pink	Kalskag	Wheel	13	22
8/17	9/4	Coho	20287	Blue	Kalskag	Drift	17	17
8/11	9/4	Coho	29925	Pink	Kalskag	Wheel	23	12
8/22	9/4	Coho	31431	Pink	Kalskag	Wheel	12	23
8/10	9/5	Coho	20052	Blue	Kalskag	Drift	25	11
8/19	9/5	Coho	31270	Pink	Kalskag	Wheel	16	18
8/20	9/5	Coho	31304	Pink	Kalskag	Wheel	15	19
8/21	9/5	Coho	31402	Pink	Kalskag	Wheel	14	20
8/22	9/5	Coho	31478	Pink	Kalskag	Wheel	13	22
8/23	9/5	Coho	31592	Pink	Kalskag	Wheel	12	23
8/17	9/6	Coho	20292	Blue	Kalskag	Drift	19	15
8/18	9/6	Coho	20316	Blue	Kalskag	Drift	18	16
8/21	9/6	Coho	20378	Blue	Kalskag	Drift	15	19
8/17	9/6	Coho	31191	Pink	Kalskag	Wheel	19	15
8/21	9/6	Coho	31400	Pink	Kalskag	Wheel	15	19
8/22	9/6	Coho	31444	Pink	Kalskag	Wheel	14	20
8/22	9/6	Coho	31452	Pink	Kalskag	Wheel	14	20
8/23	9/6	Coho	31649	Pink	Kalskag	Wheel	13	22
8/17	9/7	Coho	20277	Blue	Kalskag	Drift	20	14
8/20	9/7	Coho	20369	Blue	Kalskag	Drift	17	17
8/21	9/7	Coho	31339	Pink	Kalskag	Wheel	16	18
8/21	9/7	Coho	31392	Pink	Kalskag	Wheel	16	18
8/22	9/7	Coho	31428	Pink	Kalskag	Wheel	15	19
8/22	9/7	Coho	31464	Pink	Kalskag	Wheel	15	19
8/23	9/7	Coho	31591	Pink	Kalskag	Wheel	14	20
8/23	9/7	Coho	31611	Pink	Kalskag	Wheel	14	20
8/23	9/7	Coho	31613	Pink	Kalskag	Wheel	14	20

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Appendix A.2. (Page 2 of 5).

Tagged	Recovered	Species	Tag Information		Tagging Location	Tagging Gear	Travel in Days	Travel in Miles/Day
			Tag No.	Tag Color				
8/24	9/7	Coho	31702	Pink	Kalskag	Wheel	13	22
8/25	9/7	Coho	31773	Pink	Kalskag	Wheel	12	23
8/13	9/8	Coho	20200	Blue	Kalskag	Drift	25	11
8/23	9/8	Coho	31621	Pink	Kalskag	Wheel	15	19
8/23	9/8	Coho	31644	Pink	Kalskag	Wheel	15	19
8/25	9/8	Coho	31763	Pink	Kalskag	Wheel	13	22
8/25	9/8	Coho	31769	Pink	Kalskag	Wheel	13	22
8/10	9/9	Coho	20053	Blue	Kalskag	Drift	29	10
8/13	9/10	Coho	20184	Blue	Kalskag	Drift	27	10
8/26	9/10	Coho	20413	Blue	Kalskag	Drift	14	20
8/27	9/10	Coho	31953	Pink	Kalskag	Wheel	13	22
8/24	9/11	Coho	31663	Pink	Kalskag	Wheel	17	17
8/25	9/11	Coho	31818	Pink	Kalskag	Wheel	16	18
8/25	9/11	Coho	38018	Blue	Kalskag	Drift	16	18
8/8	9/12	Coho	29775	Pink	Kalskag	Wheel	34	8
8/28	9/12	Coho	30147	Pink	Kalskag	Wheel	14	20
8/30	9/12	Coho	30226	Pink	Kalskag	Wheel	12	23
8/23	9/12	Coho	31619	Pink	Kalskag	Wheel	19	15
8/25	9/12	Coho	31842	Pink	Kalskag	Wheel	17	17
8/27	9/12	Coho	31955	Pink	Kalskag	Wheel	15	19
8/29	9/13	Coho	30210	Pink	Kalskag	Wheel	14	20
8/31	9/13	Coho	30294	Pink	Kalskag	Wheel	13	22
8/31	9/13	Coho	30303	Pink	Kalskag	Wheel	13	22
9/2	9/13	Coho	30396	Pink	Kalskag	Wheel	11	26
8/25	9/13	Coho	31803	Pink	Kalskag	Wheel	18	16
8/25	9/13	Coho	31817	Pink	Kalskag	Wheel	18	16
8/25	9/13	Coho	31872	Pink	Kalskag	Wheel	18	16
8/26	9/13	Coho	31928	Pink	Kalskag	Wheel	17	17
8/27	9/13	Coho	38026	Pink	Kalskag	Drift	16	18
9/1	9/14	Coho	30353	Pink	Kalskag	Wheel	13	22
8/31	9/14	Coho	30438	Pink	Kalskag	Drift	14	20
9/2	9/14	Coho	30454	Pink	Kalskag	Wheel	12	23
9/4	9/14	Coho	30541	Pink	Kalskag	Wheel	10	28
8/27	9/14	Coho	38021	Blue	Kalskag	Drift	17	17
8/28	9/15	Coho	30163	Pink	Kalskag	Wheel	17	17
8/31	9/15	Coho	30319	Pink	Kalskag	Wheel	15	19
9/2	9/15	Coho	30383	Pink	Kalskag	Wheel	13	22
8/28	9/16	Coho	30171	Pink	Kalskag	Wheel	18	16
9/2	9/16	Coho	30407	Pink	Kalskag	Wheel	14	20
9/2	9/16	Coho	30450	Pink	Kalskag	Wheel	14	20
9/3	9/16	Coho	30480	Pink	Kalskag	Wheel	13	22
8/26	9/16	Coho	31910	Pink	Kalskag	Wheel	20	14
9/6	9/17	Coho	30627	Pink	Kalskag	Wheel	11	26
9/7	9/18	Coho	30646	Pink	Kalskag	Wheel	11	26
						Averages	17	17
7/30	8/22	coho	23640	Green	Birch Tree	Wheel	22	12
8/3	8/25	coho	24700	Green	Birch Tree	Wheel	22	12
8/5	8/25	coho	25000	Green	Birch Tree	Wheel	20	13
8/6	8/25	coho	25079	Green	Birch Tree	Wheel	19	14
8/7	8/25	coho	25431	Green	Birch Tree	Wheel	18	15

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Appendix A.2. (Page 3 of 5).

Tagged	Recovered	Species	Tag Information		Tagging Location	Tagging Gear	Travel in Days	Travel in Miles/Day
			Tag No.	Tag Color				
8/10	8/27	coho	25795	Green	Birch Tree	Wheel	17	16
8/6	8/29	coho	25229	Green	Birch Tree	Wheel	23	11
8/7	8/29	coho	25347	Green	Birch Tree	Wheel	22	12
8/11	8/29	coho	36208	White	Birch Tree	Drift	18	15
8/6	8/30	coho	25085	Green	Birch Tree	Wheel	24	11
8/15	8/30	coho	26447	Green	Birch Tree	Wheel	15	18
8/3	8/31	coho	24704	Green	Birch Tree	Wheel	28	9
8/7	8/31	coho	25428	Green	Birch Tree	Wheel	24	11
8/10	8/31	coho	25812	Green	Birch Tree	Wheel	21	13
8/15	8/31	coho	26445	Green	Birch Tree	Wheel	16	17
8/7	9/1	coho	25344	Green	Birch Tree	Wheel	24	11
8/10	9/1	coho	25825	Green	Birch Tree	Wheel	21	13
8/12	9/1	coho	26088	Green	Birch Tree	Wheel	19	14
8/14	9/1	coho	26251	Green	Birch Tree	Wheel	17	16
8/14	9/1	coho	26270	Green	Birch Tree	Wheel	17	16
8/14	9/1	coho	26351	Green	Birch Tree	Wheel	17	16
8/17	9/1	coho	26625	Green	Birch Tree	Wheel	14	19
8/17	9/1	coho	26661	Green	Birch Tree	Wheel	14	19
8/18	9/1	coho	26675	Green	Birch Tree	Wheel	13	20
8/1	9/1	coho	36025	White	Birch Tree	Drift	30	9
8/8	9/1	coho	36123	White	Birch Tree	Drift	23	11
8/10	9/1	coho	36190	White	Birch Tree	Drift	21	13
8/10	9/1	coho	36193	White	Birch Tree	Drift	21	13
8/14	9/1	coho	36273	White	Birch Tree	Drift	17	16
8/15	9/1	coho	36317	White	Birch Tree	Drift	16	17
8/17	9/1	coho	36386	White	Birch Tree	Drift	14	19
8/7	9/2	coho	25243	Green	Birch Tree	Wheel	25	11
8/16	9/2	coho	26537	Green	Birch Tree	Wheel	16	17
8/19	9/2	coho	26863	Green	Birch Tree	Wheel	13	20
8/14	9/2	coho	36289	White	Birch Tree	Drift	18	15
8/19	9/2	coho	36448	White	Birch Tree	Drift	13	20
8/17	9/3	coho	26643	Green	Birch Tree	Wheel	16	17
8/20	9/4	coho	26913	Green	Birch Tree	Wheel	14	19
8/21	9/4	coho	35067	White	Birch Tree	Drift	13	20
8/6	9/5	coho	25122	Green	Birch Tree	Wheel	29	9
8/7	9/5	coho	25260	Green	Birch Tree	Wheel	28	9
8/14	9/5	coho	26245	Green	Birch Tree	Wheel	21	13
8/16	9/5	coho	26484	Green	Birch Tree	Wheel	19	14
8/19	9/5	coho	26824	Green	Birch Tree	Wheel	16	17
8/19	9/5	coho	26886	Green	Birch Tree	Wheel	16	17
8/19	9/5	coho	26896	Green	Birch Tree	Wheel	16	17
8/21	9/5	coho	27061	Green	Birch Tree	Wheel	14	19
8/21	9/5	coho	27071	Green	Birch Tree	Wheel	14	19
8/22	9/5	coho	27123	Green	Birch Tree	Wheel	13	20
8/22	9/5	coho	35125	White	Birch Tree	Drift	13	20
8/7	9/5	coho	36097	White	Birch Tree	Drift	28	9
8/16	9/5	coho	36353	White	Birch Tree	Drift	19	14
8/17	9/5	coho	36385	White	Birch Tree	Drift	18	15
8/19	9/5	coho	36477	White	Birch Tree	Drift	16	17
8/15	9/6	coho	26409	Green	Birch Tree	Wheel	21	13

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Tagged	Recovered	Species	Tag Information		Tagging Location	Tagging Gear	Travel in Days	Travel in Miles/Day
			Date Tagged	Tag No.				
8/19	9/6	coho	26874	Green	Birch Tree	Wheel	17	16
8/20	9/6	coho	26914	Green	Birch Tree	Wheel	16	17
8/20	9/6	coho	26929	Green	Birch Tree	Wheel	16	17
8/21	9/6	coho	35062	White	Birch Tree	Drift	15	18
8/9	9/6	coho	36148	White	Birch Tree	Drift	27	10
8/16	9/6	coho	36337	White	Birch Tree	Drift	20	13
8/23	9/7	coho	27169	Green	Birch Tree	Wheel	14	19
8/24	9/7	coho	27214	Green	Birch Tree	Wheel	13	20
8/24	9/7	coho	27217	Green	Birch Tree	Wheel	13	20
8/24	9/7	coho	27234	Green	Birch Tree	Wheel	13	20
8/24	9/7	coho	27254	Green	Birch Tree	Wheel	13	20
8/20	9/7	coho	35036	White	Birch Tree	Drift	17	16
8/20	9/7	coho	35038	White	Birch Tree	Drift	17	16
8/21	9/7	coho	35108	White	Birch Tree	Drift	16	17
8/19	9/7	coho	36444	White	Birch Tree	Drift	18	15
8/19	9/7	coho	36467	White	Birch Tree	Drift	18	15
8/10	9/8	coho	25897	Green	Birch Tree	Wheel	28	9
8/19	9/8	coho	26859	Green	Birch Tree	Wheel	19	14
8/23	9/8	coho	27187	Green	Birch Tree	Wheel	15	18
8/24	9/8	coho	27229	Green	Birch Tree	Wheel	14	19
8/27	9/8	coho	27432	Green	Birch Tree	Wheel	11	24
8/20	9/8	coho	35002	White	Birch Tree	Drift	18	15
8/20	9/8	coho	35060	White	Birch Tree	Drift	18	15
8/22	9/8	coho	35136	White	Birch Tree	Drift	16	17
8/24	9/8	coho	35283	White	Birch Tree	Drift	14	19
8/18	9/9	coho	26726	Green	Birch Tree	Wheel	21	13
8/24	9/10	coho	27212	Green	Birch Tree	Wheel	16	17
8/29	9/10	coho	27471	Green	Birch Tree	Wheel	11	24
8/23	9/10	coho	35221	White	Birch Tree	Drift	17	16
8/31	9/11	coho	27619	Green	Birch Tree	Wheel	11	24
8/22	9/12	coho	27122	Green	Birch Tree	Wheel	20	13
8/26	9/12	coho	27362	Green	Birch Tree	Wheel	16	17
8/23	9/12	coho	35201	White	Birch Tree	Drift	19	14
9/1	9/12	coho	35453	White	Birch Tree	Drift	11	24
8/18	9/12	coho	36419	White	Birch Tree	Drift	24	11
8/27	9/13	coho	27421	Green	Birch Tree	Wheel	16	17
8/30	9/13	coho	27576	Green	Birch Tree	Wheel	13	20
8/31	9/13	coho	27608	Green	Birch Tree	Wheel	13	20
9/1	9/13	coho	27722	Green	Birch Tree	Wheel	12	22
8/26	9/13	coho	35321	White	Birch Tree	Drift	17	16
8/26	9/13	coho	35340	White	Birch Tree	Drift	17	16
8/16	9/13	coho	36358	White	Birch Tree	Drift	27	10
9/2	9/14	coho	27770	Green	Birch Tree	Wheel	12	22
9/3	9/14	coho	27904	Green	Birch Tree	Wheel	11	24
8/20	9/14	coho	35032	White	Birch Tree	Drift	24	11
8/22	9/14	coho	35190	White	Birch Tree	Drift	22	12
8/31	9/15	coho	27638	Green	Birch Tree	Wheel	15	18
8/30	9/15	coho	35419	White	Birch Tree	Drift	15	18
9/1	9/15	coho	35459	White	Birch Tree	Drift	14	19
8/30	9/16	coho	27514	Green	Birch Tree	Wheel	16	17
8/30	9/16	coho	27571	Green	Birch Tree	Wheel	16	17

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Tagged	Recovered	Species	Tag Information		Tagging Location	Tagging Gear	Travel in Days	Travel in Miles/Day
			Tag No.	Tag Color				
9/4	9/16	coho	27909	Green	Birch Tree	Wheel	12	22
9/3	9/18	coho	27993	Green	Birch Tree	Wheel	15	18
9/2	9/19	coho	27814	Green	Birch Tree	Wheel	17	16
9/4	9/19	coho	27974	Green	Birch Tree	Wheel	15	18
9/3	9/20	coho	27987	Green	Birch Tree	Wheel	17	16
8/30	9/21	coho	27578	Green	Birch Tree	Wheel	21	13
9/9	9/22	coho	28184	Green	Birch Tree	Wheel	13	20
Averages							18	15

**APPENDIX B**  
**CLIMATE INFORMATION FOR THE KOGRUUKLUK RIVER WEIR**

Appendix B. Daily climate data collected at the Kogrukluk River weir, 2002.

Date	Time	Cloud Cover	Precip. (mm)	Cum	Wind		Temp		Water	
					Dir	Speed (mph)	Air	Water	Level (mm)	Benchmark
6/21	12:00	100		0			15	9	1030	3230
6/21	17:00	100		0			18	9	1020	3220
6/22	7:30	10		0			5	8	950	3150
6/22	17:00	90		0			19	9	945	3145
6/23	10:30	100		0			12	8	910	3110
6/23	17:00	100		0	S	5-7	21	9	905	3105
6/24	7:30	100		0			11	9	880	3080
6/24	17:00	100		0	S	5	17	11	870	3070
6/25	7:30	100	2	2			9	9	870	3070
6/25				2			9	7.5	890	3090
6/26	7:30	20	3	5	S	5-10	9	6	910	3110
6/26	17:00	90		5			18	10	925	3125
6/27	7:30	10		5	S	5	4	8	890	3090
6/27	17:00	80		5	S	5	6	10	840	3040
6/28	7:30	80		5			8	8	830	3030
6/28	17:00	20		5			20	12	810	3010
6/29	10:00	30		5	N	5-7	15	9	800	3000
6/29	17:00	70		5			16	12	830	3030
6/30	10:00	10		5	N	5	13	11	810	3010
6/30	17:00	100		5			21	11	790	2990
7/1	7:30	100		5	N	5	12	9	760	2960
7/1	17:00	100		5			18	11	750	2950
7/2	7:30	10		5	SSE	10	8	8	760	2960
7/2	17:00	10		5	S	5-7	24	17	740	2940
7/3	7:30	60		5	N	10	12	11	730	2930
7/3	17:00	100		5	S	5	15	12	700	2900
7/4	7:30	50		5	N	10	8	10	690	2890
7/4	17:00	100		5			12	12	670	2870
7/5	7:30	25		5	S	10	8	10	660	2860
7/5	17:00	30	5	10	S	10-15	22	13	650	2850
7/6	7:00	100	5	15	S	15	11	11	620	2820
7/6	17:00	100		15	S	15	15	12	615	2815
7/7	10:00	100		15			12	9.5	600	2800
7/7				15			10.5	9.25	600	2800
7/8	15:00	100		15	S	5-10	9	9	600	2800
7/8	20:00	60		15			19	11	575	2775
7/9	7:30	100		15	S	5-7	9	10	570	2770
7/9	17:00	100		15			15	10	570	2770
7/10	7:30	60		15	S	5	8	9	545	2745
7/10	17:00	70		15			19	11	540	2740
7/11	7:30	100		15			12	11	535	2735
7/11	17:00	70		15			21	12	530	2730
7/12	7:30	100		15			13	11	531	2731
7/12	17:00	90		15	S	10	19	12	530	2730
7/13	10:30	100	1	16			12	11	510	2710
7/13	18:00	100		16	S	15	16	12	480	2680
7/14	10:30	100	2	18			14	10	525	2725
7/14	17:00	100	1	19	S	5-10	13	9	545	2745
7/15	7:30	100		19			9	9	520	2720
7/15	17:00	100		19			18	10	495	2695
7/16	7:15	100		19	S	5	9	9	515	2715

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## Appendix B. (Page 2 of 4)

Date	Time	Cloud Cover	Precip. (mm)	Cum	Wind		Temp		Water	
					Dir	mph	Air	Water	Level (mm)	Benchmark
7/16		50		19	N	5	24	12	475	2675
7/17	7:15	0		19			8	11	500	2700
7/17				19			9.5	11.5	487.5	2687.5
7/18	7:15	10		19			11	12	475	2675
7/18	17:00	70		19	N	0-5	28	15	410	2610
7/19	7:15	100	20	39			11	13	550	2750
7/19	17:00	100		39	S	10-15	20	13	515	2715
7/20	10:30	100	1	40	S	10	14	9	570	2770
7/20	17:00	100		40	S	10-15	17	13	490	2690
7/21	10:30	100		40			13	10	490	2690
7/21	17:00	100		40	S	10	17	11	440	2640
7/22	7:30	100	3	43			13	10	470	2670
7/22	17:00	100		43	S	15	12	10.5	440	2640
7/23	7:30	100		43			13	11	500	2700
7/23	17:00	100	1	44	S	0-5	12	11	450	2650
7/24	7:15	100	15	59			12	11	530	2730
7/24	17:00	100		59			15	11	530	2730
7/25	7:15	100	5	64			12	10	680	2880
7/25	17:00	100		64	S	5	16	12	660	2860
7/26	10:30	100	3	67	S	5	12	10	645	2845
7/26	17:00	100	6	73			14	11	570	2770
7/27	10:30	100	8	81	S	5	12	11	670	2870
7/27	23:00	60	1	82	S	5	16	11	680	2880
7/28	10:30	50	1	83	S	5	9	9	740	2940
7/28	17:00	90		83	N	5	17	11	620	2820
7/29	7:30	0		83			6	9	630	2830
7/29	17:00			83	N	10-15	20	12	530	2730
7/30	7:30	0		83	S	5	7	11	550	2750
7/30	17:00	0		83	N	5	28	14	475	2675
7/31	7:30	0		83			8	12	500	2700
7/31	17:00	30		83	N	5-7	26	14	460	2660
8/1	7:30	70		83			7	12	465	2665
8/1	17:00			83	N	5	26	14	530	2730
8/2	7:30			83	S	0-5	9	11	440	2640
8/3	7:30	0		83			9	11	470	2670
8/3	10:00			83			14	11	470	2670
8/3	17:00			83	N	5	27	14	370	2570
8/4	10:30	0		83			14	11	330	2530
8/4	17:00	0		83	S	10	28	14	390	2590
8/5	10:30			83			16	9	440	2640
8/5	17:00			83	S	0-5	18	13	450	2650
8/6	7:30	2		85			14	12	360	2560
8/6	17:00			85	N	7	17	13	350	2550
8/7	7:30	4		89	NW	5	13	13	380	2580
8/7	17:00			89			16	13	370	2570
8/8	10:30	5		94	N	10-15	12	10	390	2590
8/8	17:00			94	N	10	16	13	365	2565
8/9	7:30			94			8	11	360	2560
8/9	17:00			94	N	10-13	16	12	340	2540
8/10	7:30			94	S	0-5	6	11	340	2540
8/10	17:00			94	NW	0-5	14	11	320	2520

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Appendix B. (Page 3 of 4)

Date	Time	Cloud Cover	Precip. (mm)	Cum	Wind		Temp		Water	
					Dir	mph	Air	Water	Level (mm)	Benchmark
8/11	7:30		2	96	NW	5-7	8	9	320	2520
8/11	17:00		3	99			13	11	320	2520
8/12	7:30		10	109			10	10	320	2520
8/12	17:00			109			14	11	360	2560
8/13	7:30		3.5	112.5			4	10	400	2600
8/13	17:00			112.5	NW	5-10	18	12	390	2590
8/14	7:30			112.5	S	2-3	3	10	360	2560
8/14	17:00			112.5			18	12	340	2540
8/15	7:30		2	114.5			11	11	330	2530
8/15	17:00			114.5	N	15-20	17	12	320	2520
8/16	7:30			114.5			11	10	320	2520
8/16	17:00			114.5	NW	5-10	18	13	320	2520
8/17	7:30			114.5			9	12	320	2520
8/17	17:00			114.5	N	15-20	18	14	320	2520
8/18	7:30			114.5			4	10	290	2490
8/18				114.5			5.5	10.5	282.5	2482.5
8/19	7:30			114.5			7	11	275	2475
8/19	17:00			114.5	NW	10	9	11	275	2475
8/20	7:30		2	116.5	NW	10-15	7	10	285	2485
8/20	17:00		14	130.5	NW	10-15	9	9	310	2510
8/21	7:30		22	152.5			9	9	390	2590
8/21	17:00			152.5			14	11	470	2670
8/22	7:30		4	156.5			12	10	470	2670
8/22	17:00			156.5	NW	5	14	11	460	2660
8/23	7:30		16	172.5			10	11	550	2750
8/23	17:00			172.5			9	11	595	2795
8/24	7:30		6	178.5			8	11	640	2840
8/24	17:00		8	186.5	S	0-5	14	13	720	2920
8/25	7:30		9	195.5			12	11	710	2910
8/25	17:00			195.5			17	11	625	2825
8/26	7:30			195.5			3	12	590	2790
8/26				195.5			4.5	11	565	2765
8/27	7:30			195.5			6	10	540	2740
8/27	17:00			195.5			18	9	490	2690
8/28	7:30			195.5			8	11	460	2660
8/28	17:00			195.5			15	10	450	2650
8/29	7:30			195.5			8	11	445	2645
8/29	17:00			195.5			12	9	440	2640
8/30	7:30		6	201.5			9	10	435	2635
8/30	17:00		5	206.5	NW	0-5	14	9	450	2650
8/31	7:30		22	228.5			9	9	470	2670
8/31	17:00		2	230.5	NW	10-20	11	11	565	2765
9/1	10:30			230.5			8	14	640	2840
9/1	17:00			230.5	NW	5	15	9	600	2800
9/2	10:30			230.5			5	10	560	2760
9/2	17:00			230.5	NW	0-15	14	9	510	2710
9/3	10:30			230.5			5	10	485	2685
9/3	17:00			230.5			15	8	460	2660
9/4	10:30			230.5			12	9	450	2650
9/4	17:00			230.5	S	10-15	17	9	430	2630
9/5	10:30		3	233.5	S	5-10	13	10	440	2640

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Appendix B. (Page 4 of 4)

Date	Time	Cloud Cover	Precip. (mm)	Cum	Wind		Temp		Water	
					Dir	mph	Air	Water	Level (mm)	Benchmark
9/5	17:00			233.5	S	10-15	15	11	460	2660
9/6	10:30			233.5			11	9	540	2740
9/6	17:00	2		235.5	S	0-5	14	11	520	2720
9/7	10:30	4		239.5			8	9	490	2690
9/7	17:00			239.5			12	10	480	2680
9/8	10:30	3		242.5	N	0-5	8	9	470	2670
9/8	17:00	1		243.5	N	5	11	10	460	2660
9/9	10:30			243.5			6	8	470	2670
9/9				243.5			7	8	455	2655
9/10	10:30			243.5			8	8	440	2640
9/10	17:00			243.5	W	5-10	13	8	430	2630
9/11	10:30	2		245.5	S	5	9	7	420	2620
9/11	17:00	2		247.5			13	9	420	2620
9/12	10:30	8		255.5	S	30	9	8	430	2630
9/12	17:00	1		256.5	S	25	13	9	440	2640
9/13	7:30	2		258.5			8	9	520	2720
9/13	17:00			258.5	S	0-10	12	9	520	2720
9/14	7:30	5		263.5			8	9	520	2720
9/14	17:00	3		266.5			13	9	510	2710
9/15	10:30	5		271.5	N	5-7	6	8	580	2780
9/15	17:00			271.5	N	5-10	12	9	575	2775
9/16	10:00			271.5	S	0-5	1.5	6.5	535	2735
9/16	17:00			271.5			9	8	520	2720
9/17	10:00			271.5	S	0-5	3	6	495	2695
9/17				271.5			3	6.5	482.5	2682.5
9/18	10:00			271.5			3	7	470	2670
9/18	17:00			271.5	N	15	3	8	465	2665
9/19	10:30			271.5	NNW	5-10	3	6	455	2655
9/19	17:00			271.5	NW	10-15	8.5	8	450	2650
9/20	10:00			271.5			-2	5	440	2640
9/20				271.5			-2.5	4.5	435	2635
9/21	10:00			271.5			-3	4	430	2630
9/21	17:00			271.5	NW	15-20	11	6	425	2625
9/22	10:00			271.5	NW	10	3	5	420	2620
9/22	17:00			271.5	NW	10	7	6	420	2620
9/23	10:00			271.5	S	5	10	6	430	2630
9/23	17:00			271.5	S	10	12	7	450	2650
9/24	10:00	2		273.5	N	0-5	8	7	585	2785
9/24	17:00	3		276.5			11	8	590	2790
9/25	10:00	6		282.5			9	8	600	2800
9/25	17:00			282.5	S	5	10	8	580	2780
9/26	10:00	4		286.5	S	20-25	8	7	565	2765
9/26	17:00			286.5	S	20	11	8	580	2780
9/27	10:00	2		288.5	S	0-20	8		650	2850
9/27				288.5			7.75	7	720	2920
9/28	10:00	1		289.5			7.5	7	630	2830
9/28	17:00			289.5	NW	5-10	11	8	610	2810
9/29	10:00	4		293.5	E	5	8	7	590	2790
9/29	17:00	3		296.5	W	0-5	10	7	590	2790
				Average			11.83044554	7.2	536	2736

**APPENDIX C**  
**HISTORICAL SALMON PASSAGE AT THE KOGRUKLUK RIVER WEIR**

Appendix C.1. Factor table for historical salmon escapement estimates, Kogrukuk River 1976-2002.

Chinook				Chum				Sockeye				Coho <sup>a</sup>			
Year	T <sup>b</sup>	Prop.	Est'd	T <sup>b</sup>	Prop.	Est'd	T <sup>b</sup>	Prop.	Est'd	T <sup>b</sup>	Prop.	Est'd	T <sup>b</sup>	Prop.	Est'd
1976	L	5,500	0.0142	5,379	N	8,046	0.0087	8,117	N	2,302	0.0103	2,326			
1977	(N)	763	0.0777	1,945	(N)	7,404	0.6192	19,443	(N)	732	0.5528	1,637			
1978	N	13,102	0.0413	13,667	N	47,099	0.0213	48,125	N	1,646	0.0144	1,670			
1979	N	10,104	0.1088	11,338	L	13,959	0.2329	18,198	N	2,432	0.0746	2,628			
1980		676	c	6,572		5,638	c	41,777		403	c	3,200			
1981	E	16,052	0.0362	16,655	E	56,262	0.0192	57,365	E	17,691	0.0208	18,066	N	11,450	0.0004
1982	E	5,325	0.5156	10,993	N	43,422	0.3222	64,063	E	11,729	0.3219	17,297	N	35,582	0.0586
1983	(N)	1,032	0.6570	3,009	(N)	3,248	0.6547	9,407	(N)	375	0.6811	1,176	L	8,327	0.0247
1984	N	4,928	0.0000	4,928	N	41,484	0.0000	41,484	N	4,133	0.0000	4,133	E	25,304	0.0810
1985	L	4,034	0.1267	4,619	L	13,851	0.0769	15,005	L	4,344	0.0034	4,359	E	14,318	0.1291
1986	L	2,922	0.4200	5,038	N	11,980	0.1846	14,693	N	3,252	0.2301	4,224	E	14,717	0.3461
1987	d		4,063		d		17,422		d		973	N	19,756	0.1343	22,821
1988	N	7,677	0.0974	8,505	E	28,498	0.2793	39,540	E	4,235	0.0368	4,397	N	11,722	0.1325
1989	N	4,908	0.5889	11,940	N	15,543	0.6070	39,549	N	2,599	0.5527	5,811			e
1990	N	10,097	0.0118	10,218	N	26,555	0.0078	26,765	N	8,382	0.0029	8,406	L	2,736	0.5538
1991	N	6,112	0.2189	7,850	L	21,331	0.1181	24,188	N	14,450	0.1218	16,455	L	7,059	0.2915
1992	N	6,397	0.0530	6,755	N	32,051	0.0602	34,105	L	7,328	0.0281	7,540	(N)	2,715	0.8958
1993	N	10,516	0.1473	12,332	N	26,926	0.1559	31,899	N	27,219	0.0729	29,358	(N)	4,437	0.7837
1994	(E)	8,310	0.4543	15,227	(E)	21,756	0.4906	46,635	L	5,676	0.6001	14,192	(E)	27,461	0.2085
1995	E	18,856	0.0860	20,630	N	28,292	0.0951	31,265	N	10,581	0.0377	10,996	E	17,492	0.3722
1996	E	13,734	0.0327	14,199	E	47,010	0.0306	48,495	N	15,221	0.0107	15,385	E	47,011	0.0701
1997	E	13,112	0.0131	13,286	L	7,902	0.0070	7,958	N	13,059	0.0015	13,078	L	11,611	0.0512
1998	(L)	1,009	0.7515	12,107	(L)	13,014	0.6429	36,441	(L)	5,321	0.6828	16,773	L	22,614	0.0712
1999	L	5,472	0.0176	5,370	L	13,497	0.0234	13,820	L	5,777	0.0148	5,864	L	10,094	0.1995
2000	L	3,180	0.0393	3,310	L	11,077	0.0360	11,491	L	2,778	0.0310	2,867	E	32,875	0.0078
2001	N	6,567	0.2937	9,298	L	23,009	0.2473	30,569	N	6,634	0.2438	8,773	E	18,308	0.0557
2002		9,590	0.0509	10,104		49,494	0.0403	51,570		3,913	0.0338	4,050		14,501	0.0010

a Coho migrations were not monitored prior to 1981

b The timing model used for estimating missed counts depends on the distribution of the mean date of migration (E-early, N-normal, L-late). The use of () indicates assumed timing.

c From Baxter (1980), insufficient data to estimate escapements using time series techniques

d Except for coho, escapements were estimated from a ratio of unknown 1987 escapement and known 1987 aerial assessments to known 1988 escapement and known 1988 aerial assessment  
Coho escapements estimated using time series techniques

e Heavy rain and high river levels allowed only two days of counts during the coho migration



Appendix C.2. (Page 2 of 6).

Date	Daily Passage										
	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
6/15											
6/16											
6/17											
6/18			1 b				0 b				
6/19	1 b	1 b	2 b	2 b	1 b	1 b					
6/20	1 b	1 b	4 b	2 b	1 b	2 b	1 b				
6/21	1 b	2 b	9 b	2 b	1 b	2 b	1 b		1 b		
6/22	2 b	4 b	19 b	6 b	4 b	4 b	4 b			3 b	
6/23	5 b	9 b	38 b	17 b	12 b	9 b	2 b			7 b	
6/24	8 b	14 b	71 b	23 b	16 b	15 b	4 b			9 b	
6/25	14 b	26 b	146 b	43 b	30 b	28 b	3 b			17 b	
6/26	16 b	30 b	91 b	51 b	36 b	34 b	9 b			27 b	15
6/27	32 b	59 b	291 b	97 b	68 b	67 b	88 b			44 b	143
6/28	44 b	81 b	304 b	137 b	96 b	51	39 b			29 b	103
6/29	67 b	122 b	485 b	208 b	146 b	610	118 b			124 b	279
6/30	69 b	125 b	512 b	206 b	80	596	79 b			54 b	89
7/1	72 b	250 b	562 b	417 b	264	507	198 b	6 b		139 b	187
7/2	255	293 b	423	516 b	998	172	157 b	2 b	1	255 b	310
7/3	387	606	268	313	831	927	254 b	2 b	42	242 b	129
7/4	163	362 b	458	2024	397	587	398 b	5 b	40	543 b	618
7/5	235	657 b	1130	1462	1464	1025	433 b	43 b	95	160	90
7/6	74	708	1110	1779	1688	790	516 b	17	179	397	1192
7/7	145	876	937	1306	1788	1142	145	53	108	386	123
7/8	138	715	692	1133	880	486	817 b	41	46	698	726
7/9	817	880	1245	679	683	708	769 b	56	189	796	241
7/10	325	1004	775	1826	552	219	452 b	148	134	336	450
7/11	431	683	682 b	797	339	224	719 b	199	214	644	804
7/12	485	653	479 b	1714	418	532	992 b	258	282	513	547
7/13	138	688	447 b	764	715	303	699 b	204	149	404	442
7/14	305	426	417 b	375	515	552	598 b	287	152	448	402
7/15	408	367	510 b	246	282	398	675 b	129	186	221	381
7/16	165	409	412 b	774	181	324	617 b	355	221	444	315
7/17	326	334	345 b	689	237	377	435 b	331	150	230	330
7/18	280	411	598	373	227	477	229 b	126	102	111	311 *
7/19	195	163	271 b	475	260	357	329	295	103	316	289
7/20	144	272	221 b	274	88	392	264	221	51	264 b	269 a
7/21	167	200	171 b	266	180	346	225	788	77	184 b	269 a
7/22	165	59	166 b	362	98	208	215	265	113	208 b	249
7/23	159	101	108 b	151	56	110	98	230	78	218 b	114
7/24	103	88	71 b	134	77	53	112	235	93	141 b	176
7/25	84	52	38 b	220	99	34	205	429	57	115 b	131
7/26	33	76	37 b	159	31	100	127	81	30	57 b	82
7/27	26	77	29 b	135	25	13	184	113	53	43 b	50
7/28	27	121	47	67	27	81	194	68	25	50	37
7/29	30	76 b	141	67	52	37	114	93	19	72	32
7/30	20	50 b	108	76	99	47	110	88	14	27	31
7/31	21	19	86	27	19	36	101	52	41	46	8
8/1	17	14	58	24	16 b	20	64	54	24	29	23
8/2	25	7	27	25	12 b	30	58	41	37	53	12
8/3	10	16	25	47	9	25	31	24	35 b	24	11
8/4	9 b	25	22 b	21	7	13	25	18	29 b	17	11
8/5	9 b	23	21 b	11	2	18	30	23	26 b	9	11
8/6	8 b	20	18 b	10	6	19	17	17	22 b	14	9
8/7	14 b	29	16	4	8	13	14	7	18 b	4	6
8/8	13 b	21	19	15	10	10	20	10	4	12	11
8/9	15 b	11	2	10	2	23	15	4	7	1	7
8/10	7	15	6	10 b	14	28	5	2	10	6	1
8/11	7	5	6 b	10 b	7 b	33	10	2	3	3	5
8/12	7	11	6	15 b	10 b	9 b	3	8	3	1	5
8/13	8	6	5	6 b	4 b	4 b	7	5	9	7	3
8/14	1	0	9	4 b	3 b	4	5	4	6	4	4
8/15	5	0	7	2 b	5	13	5	1	5	11	2
8/16	9	0	4	1	1	6	5	2	1	2	1
8/17	2	0	3	1	0	5	3	3	0	1	0
8/18	4	0	0	2	1	1	2	3	0	0	0
8/19	2	0	5	0	5	7	0	1	4	0	0
8/20	1	0	1	2	3	4	4	1	3	0	0
8/21	0	0	3	3	2	1	4	0	0	1	1
8/22	9	1	1	3	2	1	2	1	2	1	2
8/23	0	0	1	4	1	0	0	2	1	1	3
8/24	0	0	0	1	0	1	1	0	1	1	1
Total	6755	12332	15227	20630	14199	13286	12107	5570	3310	9298	10104
Obs.	6356	10190	8221	18856	13734	13112	2780	5472	3189	6572	9590
Est.	399	2142	7006	1774	465	174	9327	98	130	2726	514
Subtotal	6755	12332	15227	20630	14199	13286	12107	5570	3310	9298	10104
% Obs.	94	83	54	91	97	99	23	98	96	71	95

a = Daily passage was estimated due to the occurrence of a hole in the weir

b = The weir was not operational; daily passage was estimated

c = The weir was not operational; daily passage was not estimated

d = Partial day count; passage was not estimated

e = Majority of the run estimated; weir not operational much of the season



Appendix C.2. (Page 4 of 6).

Date	Cumulative Passage										
	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
6/15											
6/16											
6/17											
6/18											
6/19	1	3	2				0				
6/20	1	2	7	4	1	2					
6/21	2	4	16	6	3	4	1				
6/22	4	8	35	12	7	8	5				
6/23	9	17	73	29	19	17	7				
6/24	17	31	144	52	35	32	11				
6/25	31	57	290	93	65	60	14				
6/26	47	87	381	146	102	94	24				
6/27	79	146	672	243	170	161	111				
6/28	123	227	976	380	265	212	151				
6/29	190	349	1461	588	412	322	268				
6/30	259	474	1973	794	492	1418	348				
7/1	331	724	2535	1211	756	1925	546	6			
7/2	386	1017	2958	1727	1754	2097	703	8	1	709	1126
7/3	973	1623	3226	2040	2853	3024	957	10	43	952	1255
7/4	1136	1985	3684	4064	2982	3611	1355	15	83	1495	1873
7/5	1371	2642	4814	5526	4446	4636	1789	58	178	1655	1963
7/6	1445	3556	5924	7305	6134	5426	2305	75	257	2052	3155
7/7	1590	4226	6861	8611	7922	6568	2450	128	465	2438	3278
7/8	1728	4941	7553	9744	8802	7054	3267	169	511	3136	4004
7/9	2545	5821	8798	10423	9485	7762	4036	225	700	3932	4245
7/10	2870	6825	9573	12249	10037	7981	4488	373	824	4268	4695
7/11	3301	7508	10255	13046	10376	8205	5267	572	1058	4912	5499
7/12	3786	8161	10734	14760	10794	8737	6199	830	1340	5427	6046
7/13	3924	8849	11181	15524	11509	9940	6898	1034	1489	5835	6488
7/14	4229	9275	11598	15899	12024	9592	7495	1321	1641	6283	6990
7/15	4637	9642	12108	16145	12306	9990	8172	1450	1827	6504	7271
7/16	4802	10051	12520	16919	12487	10314	8788	1805	2048	6948	7586
7/17	5128	10385	12865	17608	12724	10691	9243	2136	2198	7178	7916
7/18	5408	10796	13463	17981	12951	11163	9472	2262	2300	7289	8227
7/19	5603	10954	13734	18456	13211	11525	9801	2657	2403	7605	8516
7/20	5747	11230	13955	18730	13299	11917	10065	2878	2454	7869	8785
7/21	5914	11430	14126	18996	13479	12263	10290	3666	2531	8053	9054
7/22	6079	11484	14292	19358	13577	12471	10505	3931	2644	8262	9303
7/23	6238	11590	14400	19509	13633	12581	10603	4161	2722	8480	9417
7/24	6341	11678	14471	19643	13710	12634	10715	4396	2815	8621	9593
7/25	6425	11730	14569	19863	13809	12668	10920	4825	2872	8736	9724
7/26	6458	11806	14546	20022	13840	12768	11047	4906	2902	8793	9806
7/27	6484	11883	14575	20157	13865	12781	11231	5019	2955	8836	9856
7/28	6511	12004	14622	20224	13892	12862	11425	5087	2989	8886	9893
7/29	6548	12080	14763	20291	13944	12899	11539	5180	2999	8958	9925
7/30	6561	12110	14871	20367	14043	12946	11649	5268	3013	9035	9956
7/31	6582	12129	14957	20394	14062	12982	11780	5320	3054	9081	9964
8/1	6599	12143	15015	20418	14078	13002	11814	5374	3078	9110	9987
8/2	6624	12156	15042	20443	14098	13032	11872	5415	3115	9163	9999
8/3	6634	12166	15067	20490	14099	13057	11903	5439	3150	9187	10010
8/4	6643	12191	15089	20511	14106	13070	11928	5457	3179	9204	10020
8/5	6653	12214	15110	20522	14158	13088	11958	5480	3205	9213	10031
8/6	6661	12234	15128	20532	14114	13107	11975	5497	3227	9227	10040
8/7	6674	12263	15144	20536	14122	13126	11989	5504	3245	9231	10049
8/8	6687	12284	15163	20551	14132	13130	12009	5514	3249	9243	10057
8/9	6702	12295	15261	20574	14134	13153	12024	5518	3256	9244	10064
8/10	6709	12310	15171	20571	14148	13181	12029	5520	3266	9250	10065
8/11	6716	12315	15177	20581	14155	13214	12039	5522	3269	9253	10070
8/12	6723	12326	15183	20596	14165	13223	12042	5530	3272	9254	10075
8/13	6731	12332	15188	20602	14170	13227	12049	5535	3281	9261	10078
8/14	6732	12332	15197	20606	14173	13231	12054	5539	3287	9265	10082
8/15	6737	12332	15204	20608	14178	13244	12059	5540	3292	9276	10084
8/16	6746	12332	15208	20609	14179	13250	12064	5542	3293	9278	10085
8/17	6748	12332	15211	20612	14179	13255	12067	5545	3293	9279	10085
8/18	6752	12332	15211	20614	14180	13256	12069	5548	3293	9279	10085
8/19	6754	12332	15216	20614	14180	13261	12076	5548	3294	9283	10085
8/20	6755	12332	15217	20616	14183	13265	12080	5549	3297	9283	10085
8/21	6755	12332	15220	20619	14185	13266	12084	5549	3297	9284	10086
8/22	6755	12332	15221	20620	14188	13266	12085	5551	3298	9285	10088
8/23	6755	12332	15223	20621	14192	13269	12085	5551	3300	9286	10091
	6755	12332	15223	20621	14194	13269	12086	5552	3300	9287	10092
	6755	12332	15224	20622	14195	13271	12087	5554	3301	9289	10094
	6755	12332	15224	20624	14196	13279	12091	5557	3303	9294	10095
	6755	12332	15224	20626	14197	13279	12091	5557	3306	9294	10098
	6755	12332	15227	20630	14199	13284	12091	5557	3306	9294	10099
	6755	12332	15227	20630	14199	13286	12094	5570	3310	9294	10101
	6755	12332	15227	20630	14199	13286	12098	5570	3310	9295	10102
	6755	12332	15227	20630	14199	13286	12099	5570	3310	9295	10102
	6755	12332	15227	20630	14199	13286	12101	5570	3310	9297	10104
	6755	12332	15227	20630	14199	13286	12101	5570	3310	9297	10104
	6755	12332	15227	20630	14199	13286	12101	5570	3310	9297	10104
	6755	12332	15227	20630	14199	13286	12102	5570	3310	9297	10104



Appendix C.2. (Page 6 of 6).

Date	Cumulative Percent Passage										
	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
6/13											
6/16											
6/17											
6/18			0		0	0	0				
6/19	0	0	0	0	0	0	0				
6/20	0	0	0	0	0	0	0	0			
6/21	0	0	0	0	0	0	0	0	0		
6/22	0	0	0	0	0	0	0	0	0		
6/23	0	0	0	0	0	0	0	0	0		
6/24	0	0	1	0	0	0	0	0	0		
6/25	0	0	2	0	0	0	0	0	0		
6/26	1	1	3	1	1	1	1	1	1	0	
6/27	1	1	4	1	1	1	1	1	1	2	
6/28	2	2	6	2	2	2	1		1	3	
6/29	3	3	10	3	3	6	2		3	5	
6/30	4	4	13	4	3	11	3		3	6	
7/1	5	6	17	6	5	14	5	0	5	8	
7/2	9	8	19	8	12	16	6	0	0	11	
7/3	14	13	21	10	18	23	8	0	1	10	
7/4	17	16	24	20	21	27	11	0	3	16	
7/5	20	21	32	27	31	35	15	1	5	18	
7/6	21	27	39	35	43	41	19	1	11	22	
7/7	24	34	45	42	56	49	20	2	14	26	
7/8	26	40	50	47	62	53	27	3	15	34	
7/9	38	47	58	51	67	58	33	4	21	42	
7/10	42	55	63	59	71	60	37	7	25	46	
7/11	49	61	67	63	73	62	43	10	32	53	
7/12	56	66	70	72	76	66	51	15	40	58	
7/13	58	72	73	75	81	68	57	19	45	63	
7/14	63	75	76	77	85	72	62	24	50	68	
7/15	69	78	80	78	87	75	67	26	55	70	
7/16	71	82	82	82	88	78	73	32	62	75	
7/17	76	84	84	85	90	80	26	38	66	77	
7/18	80	88	88	87	91	84	78	41	69	78	
7/19	83	89	90	89	93	87	81	48	73	82	
7/20	85	91	92	91	94	90	83	52	74	85	
7/21	88	93	93	92	95	92	85	66	76	87	
7/22	90	93	94	94	96	94	87	71	80	89	
7/23	92	94	95	95	96	95	88	75	82	91	
7/24	94	95	95	95	97	95	89	79	85	93	
7/25	95	95	95	96	97	95	90	87	87	94	
7/26	96	96	96	97	97	96	91	88	88	95	
7/27	96	96	96	98	98	96	93	90	89	95	
7/28	96	97	96	98	98	97	94	91	90	96	
7/29	97	98	97	98	98	97	95	93	91	96	
7/30	97	98	98	99	99	97	96	95	91	97	
7/31	97	98	98	99	99	98	97	96	92	98	
8/1	98	98	99	99	99	98	98	96	93	98	
8/2	98	99	99	99	99	98	98	97	94	99	
8/3	98	99	99	99	99	98	98	98	95	96	
8/4	98	99	99	99	99	98	99	98	96	99	
8/5	98	99	99	99	99	99	99	98	97	99	
8/6	99	99	99	100	99	99	99	99	97	99	
8/7	99	99	99	100	99	99	99	99	98	99	
8/8	99	100	100	100	100	99	99	99	98	99	
8/9	99	100	100	100	100	99	99	99	98	99	
8/10	99	100	100	100	100	99	99	99	99	100	
8/11	99	100	100	100	100	99	99	99	100	100	
8/12	100	100	100	100	100	100	99	99	99	100	
8/13	100	100	100	100	100	100	100	99	100	100	
8/14	100	100	100	100	100	100	100	99	100	100	
8/15	100	100	100	100	100	100	100	99	100	100	
8/16	100	100	100	100	100	100	100	99	99	100	
8/17	100	100	100	100	100	100	100	100	99	100	
8/18	100	100	100	100	100	100	100	100	100	100	
8/19	100	100	100	100	100	100	100	100	100	100	
8/20	100	100	100	100	100	100	100	100	100	100	
8/21	100	100	100	100	100	100	100	100	100	100	
8/22	100	100	100	100	100	100	100	100	100	100	
8/23	100	100	100	100	100	100	100	100	100	100	
8/24	100	100	100	100	100	100	100	100	100	100	
8/25	100	100	100	100	100	100	100	100	100	100	
8/27	100	100	100	100	100	100	100	100	100	100	
8/28	100	100	100	100	100	100	100	100	100	100	
8/29	100	100	100	100	100	100	100	100	100	100	
8/30	100	100	100	100	100	100	100	100	100	100	
8/31	100	100	100	100	100	100	100	100	100	100	
9/1	100	100	100	100	100	100	100	100	100	100	
9/2	100	100	100	100	100	100	100	100	100	100	
9/3	100	100	100	100	100	100	100	100	100	100	
9/4	100	100	100	100	100	100	100	100	100	100	



Appendix C.3. (Page 2 of 6).

Date	Daily Passage										
	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
6/15											
6/16							0 b				
6/17	1 b	1 b	1 b				0 b				
6/18	1 b	0 b	1 b				0 b				
6/19	1 b	2 b	2 b	3 b	3 b	0 b	0 b	0 b			
6/20	3 b	4 b	6 b	0 b	0 b	0 b	0 b	0 b			
6/21	5 b	4 b	7 b	3 b	10 b	0 b	0 b	0 b			
6/22	11 b	11 b	16 b	9 b	24 b	1 b	1 b	5 b			
6/23	22 b	20 b	13 b	9 b	34 b	1 b	1 b	5 b			
6/24	22 b	21 b	32 b	16 b	34 b	2 b	2 b	10 b			
6/25	36 b	34 b	53 b	31 b	49 b	6 b	29 b				
6/26	61 b	58 b	92 b	44 b	122 b	8 b	38 b				247
6/27	100 b	94 b	197 b	63 b	161 b	7 b	31 b				630
6/28	175 b	165 b	249 b	25 b	229 b	44 b	54 b				474
6/29	329 b	308 b	302 b	125 b	428 b	216	203 b				973
6/30	456 b	427 b	354 b	181 b	205	157	230 b				1081
7/1	1054 b	675 b	406 b	328 b	1134	156	401 b	3 b	37 b	1045	
7/2	2416	828	439	525 b	3055	165	430 b	15 b	27	86 b	933
7/3	2613	844	511	913	2834	251	573 b	7 b	61	152 b	1111
7/4	1915	1066	547	1583	2212	245	1146 b	21 b	121	338 b	1927
7/5	1695	1000	593	2059	3537	499	788 b	51 b	190	423	1705
7/6	1011	1314	1135	1134	2868	346	1377 b	172	290	363	2389
7/7	1307	1418	1630	2149	2586	389	836	312	470	620	2266
7/8	914	1244	2439	1399	3699	362	2053 b	379	437	771	2276
7/9	1369	1417	3317	766	1277	157	1442 b	421	527	918	2373
7/10	719	1436	2421	1196	2470	192	1652 b	590	625	1044	3143
7/11	1261	1251	2634 b	1146	1511	210	2691 b	766	698	1059	3402
7/12	1250	1082	3474 b	1331 b	1754	272	1876 b	963	649	1211	3056
7/13	944	1390	2594 b	1331	3064	334	1649 b	880	429	1765	2337
7/14	1343	1006	2750 b	1151	2054	329	1312 b	651	492	1846	2094
7/15	1466	1405	2346 b	867	1366	391	2069 b	519	530	1389	2154
7/16	1254	1511	1319 b	2007	1391	304	1274 b	590	786	1811	2175
7/17	907	2030	962 b	1770	1601	247	2088 b	473	491	780	665
7/18	1262	1785	2784	1023	1033	313	592	441	538	1221	1281 a
7/19	1071	524	608 b	1188	864	320	1175	591	564	1652	1008
7/20	812	1017	443 b	553	628	174	1522	556	338	1207 b	1103 a
7/21	484	1242	456 b	1023	1139	263	1492	577	383	1285 b	1103 a
7/22	518	500	304 b	933	569	128	1401	422	340	1254 b	1198
7/23	910	487	255 b	5015	814	163	822	481	306	765 b	1152
7/24	553	336	1021 b	727	483	71	585	458	251	999 b	2913
7/25	680	490	477 b	542	265	55	722	365	170	681 b	1138
7/26	398	266	206 b	334	182	123	514	320	221	701 b	556
7/27	467	377	213 b	306	117	100	670	353	205	439 b	468
7/28	374	489	681	249	355	192	710	269	264	407	260
7/29	299	451	1418	285	597	123	507	288	139	780	252
7/30	277	414	1354	329	415	77	359	324	161	851	149
7/31	254	307	1272	216	190	36	299	252	205	539	106
8/1	164	205	793	171	170 b	48	153	243	100	449	71
8/2	240	127	642	206	151 b	50	141	173	85	555	55
8/3	183	109	655	209	131	56	120	129	107 b	318	38 b
8/4	104	127	537 b	104	99	38	192	187	91 b	256	38 b
8/5	63	104	420 b	59	53	33	145	123 b	83 b	139	38 b
8/6	49	150	303 b	42	82	42	92	103 b	71 b	227	21
8/7	97	114	185	47	51	32	51	34	62 b	168	14
8/8	59	79	183	44	50	21	42	57	9	154	18
8/9	29	43	118	37	24	28	25	15	26	68	15
8/10	60	15	100	32	60	27	23	30	29	74	8
8/11	69	10	75 b	41 b	15 b	68	19	27	15	75	5
8/12	70	15	51	53 b	19 b	15 b	10	34	17	74	18
8/13	82	26	36	47 b	29 b	16 b	8	23	34	31	25
8/14	25	4 b	39	28 b	5 b	7	11	12	11	24	6
8/15	25	0 b	26	16 b	16	11	11	11	4	18	5
8/16	17	4 b	20	5	5	15	3	9	6	28	4
8/17	16	4 b	19	2	2	5	11	10	6	15	2
8/18	9	4 b	15	3	5	2	3	1	22	11	3
8/19	1	4 b	5	7	6	2	4	0	6	8 b	1
8/20	4	4 b	7	3	4	4	4	4	1	7 b	0
8/21	13	3	1	8	1	1	1	5	1	2	5
8/22		1	3	5	0	3	6	0	2	5	
8/23		2	0	6	0	1	2	0	5	3	
8/24		4	6	1	0	3	1	1	3	3	
8/25		2	0	7	1	1	4	0	2	3	
Total	34105	31899	46635	31265	48495	7958	36442	13820	11491	30569	51370
Obs.	31826	29223	23487	28379	47010	7858	13014	13497	11077	22550	49494
Est.	2379	2676	21148	2886	1485	100	23428	323	414	3019	2076
Total	34105	31899	46635	31265	48495	7958	36442	13820	11491	30569	51370
% Obs.	93	92	50	93	97	99	36	99	96	74	96

a = Daily passage was estimated due to the occurrence of a hole in the weir.

b = The weir was not operational; daily passage was estimated

c = The weir was not operational; daily passage was not estimated

d = Partial day count, passage was not estimated

e = Majority of the run estimated due ; weir not operational much of the season



Appendix C.3. (Page 4 of 6).

Date	Cumulative Passage										
	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
6/15						0					
6/16						0					
6/17	1	1	1			0					
6/18	2	1	2			0					
6/19	3	3	4	3	5	0	0				
6/20	8	7	10	3	5	0	0				
6/21	13	11	17	6	15	0	0				
6/22	24	22	33	15	39	1	3				
6/23	46	42	66	24	73	2	10				
6/24	68	63	98	40	107	4	19				
6/25	104	97	151	71	156	10	48				
6/26	165	155	243	115	278	18	86				247
6/27	265	249	440	178	439	23	119				877
6/28	440	414	689	203	668	69	172				1381
6/29	769	722	991	328	1096	285	375				2324
6/30	1225	1149	1345	509	1301	442	605				3405
7/1	2279	1824	1751	837	2435	598	1007	3			4450
7/2	4695	2652	2210	1362	5490	763	1417	18	27	163	5383
7/3	7310	3496	2721	2275	8324	1014	2010	25	88	315	6494
7/4	9225	4562	3268	3858	10536	1259	3156	46	209	653	8421
7/5	10920	5562	3861	5908	14073	1738	3945	97	399	1076	10126
7/6	11931	6876	4995	7042	16941	2104	5326	269	689	1439	12515
7/7	13138	8294	6626	9191	19627	2493	6158	581	1139	2039	14781
7/8	14852	9538	9065	10590	23326	2855	8211	960	1596	2830	17057
7/9	15221	10955	12382	11356	24603	3012	9652	1381	2123	3748	19430
7/10	15949	12391	14803	12552	27073	3204	11304	1971	2748	4792	22573
7/11	17201	13642	17437	13698	28384	3414	13995	2737	3446	5831	25975
7/12	18451	14724	20911	15037	30338	3686	15871	3700	4095	7062	29011
7/13	19395	16114	23505	16568	31402	4020	17520	4580	4524	8827	31368
7/14	20738	17126	26255	17719	33456	4549	18812	5231	4926	10673	33462
7/15	22024	18525	28601	18586	36822	4740	20902	5779	5486	12362	35616
7/16	23458	20036	29928	19593	38213	5644	22175	6360	6242	14073	37791
7/17	34365	22066	30882	21363	39814	5291	24264	6833	6733	14853	38456
7/18	25627	23851	33666	22386	40847	5604	24856	7274	7271	16074	39739
7/19	26698	24375	34274	23574	41711	5924	26031	7865	7775	17726	40747
7/20	27510	2592	34717	24217	42339	6098	27535	8421	8113	18933	41830
7/21	27994	26634	35173	25150	43478	6361	29045	8998	8496	20218	42953
7/22	28512	27134	35477	26083	44047	6489	30146	9420	8836	21472	44151
7/23	29422	27621	35732	27098	44861	6652	30968	9901	9142	22237	45303
7/24	29975	27957	36753	27825	45344	6723	31553	10359	9933	23227	48216
7/25	30655	28447	37230	28367	45809	6778	32275	10724	9563	23999	49354
7/26	31053	28713	37436	28701	45791	6991	32789	11044	9784	24611	49910
7/27	31520	29998	37649	29007	45908	7001	33459	11397	9987	25079	50378
7/28	31894	29579	38330	29256	46263	7193	34169	11666	10191	25477	50638
7/29	32193	30630	39748	29541	46860	7316	34676	11954	10330	26257	50890
7/30	32470	30444	41102	29870	47275	7393	35035	12278	10491	27108	51039
7/31	32724	30751	42374	30986	47465	7429	35325	12530	10696	27647	51145
8/1	32888	30956	43167	30257	47635	7477	35478	12775	10796	28096	51218
8/2	33128	31083	43809	30463	47786	7527	35619	12948	10881	28651	51273
8/3	33111	31192	44464	30672	47917	7583	35739	13077	10988	28969	51311
8/4	33415	31319	45001	30776	48016	7621	35931	13264	11079	29223	51349
8/5	33480	31423	45421	30835	48089	7654	36076	13387	11162	29564	51387
8/6	33529	31573	45724	30877	48151	7696	36168	13490	11233	29791	51409
8/7	33625	31687	45909	30924	48202	7728	36219	13524	11295	29959	51422
8/8	33684	31766	46092	30968	48252	7749	36261	13581	11304	30113	51440
8/9	33714	31809	46210	31005	48276	7777	36286	13616	11330	30181	51455
8/10	33774	31834	46310	31037	48336	7804	36309	13646	11359	30255	51463
8/11	33843	31834	46385	31078	48351	7872	36318	13673	11374	30330	51468
8/12	33913	31849	46436	31131	48370	7887	36338	13707	11391	30404	51486
8/13	33995	31875	46472	31178	48399	7903	36346	13730	11425	30433	51513
8/14	34020	31879	46511	31206	48404	7910	36357	13742	11436	30459	51517
8/15	34045	31879	46557	31222	48420	7921	36368	13753	11446	30477	51522
8/16	34062	31883	46557	31227	48425	7936	36371	13758	11446	30505	51526
8/17	34078	31887	46576	31229	48427	7941	36382	13768	11452	30518	51528
8/18	34087	31891	46591	31232	48432	7943	36385	13771	11474	30529	51531
8/19	34088	31895	46596	31239	48438	7945	36389	13771	11489	30537	51532
8/20	34092	31899	46603	31242	48442	7949	36393	13775	11481	30544	51532
8/21	34105			46606	31243	48450	7950	36394	13780	11482	30551
8/22				46607	31246	48455	7950	36397	13786	11482	30553
8/23				46609	31246	48461	7950	36398	13788	11482	30558
8/24				46613	31252	48462	7950	36401	13789	11483	30561
8/25				46615	31252	48469	7951	36402	13793	11483	30563
8/26				46620	31254	48472	7951	36407	13794	11489	30564
8/27				46625	31255	48474	7951	36409	13796	11489	30564
8/28				46630	31256	48475	7951	36414	13796	11489	30565
8/29				46635	31265	48495	7958	36415	13798	11489	30565
8/30							36416	13829	11498	30569	31556
8/31							36416	13829	11498	30569	31557
9/1							36423	13829	11491	30569	31561
9/2							36425	13829	11498	30569	31561
9/3							36425	13829	11498	30569	31561
9/4							36425	13829	11498	30569	31561
9/5							36425	13829	11498	30569	31561
9/6							36425	13829	11498	30569	31561
9/7							36425	13829	11498	30569	31561
9/8							36426	13829	11493	30569	31564
9/9							36427	13829	11491	30569	31564



Appendix C.3. (Page 6 of 6).

Date	Cumulative Percent Passage										
	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
6/15											
6/16											
6/17	0	0	0	0	0	0	0	0	0	0	0
6/18	0	0	0	0	0	0	0	0	0	0	0
6/19	0	0	0	0	0	0	0	0	0	0	0
6/20	0	0	0	0	0	0	0	0	0	0	0
6/21	0	0	0	0	0	0	0	0	0	0	0
6/22	0	0	0	0	0	0	0	0	0	0	0
6/23	0	0	0	0	0	0	0	0	0	0	0
6/24	0	0	0	0	0	0	0	0	0	0	0
6/25	0	0	0	0	0	0	0	0	0	0	0
6/26	0	0	1	0	1	0	0	0	0	0	0
6/27	1	1	1	1	1	0	0	0	0	0	2
6/28	1	1	1	1	1	1	0	0	0	0	3
6/29	2	2	2	1	2	4	1	0	0	0	5
6/30	4	4	3	2	3	6	2	0	0	0	7
7/1	7	6	4	3	5	8	3	0	0	0	9
7/2	14	8	5	4	11	10	4	0	0	1	10
7/3	21	11	6	7	17	13	6	0	1	1	13
7/4	27	14	7	12	22	16	9	0	2	2	16
7/5	32	17	8	19	29	22	11	1	3	4	20
7/6	35	22	11	23	35	26	15	2	6	5	24
7/7	39	26	14	29	40	31	17	4	10	7	29
7/8	41	30	19	34	48	36	23	7	14	9	31
7/9	45	34	27	36	51	38	26	10	18	12	38
7/10	47	39	32	40	56	40	31	14	24	16	44
7/11	50	43	37	44	59	43	38	20	30	19	50
7/12	54	46	45	48	63	46	44	27	36	23	56
7/13	57	51	50	53	69	51	48	31	39	29	61
7/14	61	54	56	57	73	55	52	38	43	35	65
7/15	65	58	61	59	76	60	57	42	47	40	69
7/16	69	63	64	63	79	63	61	46	54	46	71
7/17	71	69	66	68	82	66	67	49	59	49	75
7/18	75	75	72	72	84	70	68	53	63	53	77
7/19	78	76	73	75	86	74	71	57	68	58	79
7/20	81	80	74	77	87	77	76	61	71	62	81
7/21	82	83	75	80	90	80	80	65	74	66	83
7/22	84	85	76	83	91	82	83	68	77	70	86
7/23	86	87	77	87	93	84	85	72	80	71	88
7/24	88	88	79	89	94	84	87	75	82	76	93
7/25	90	89	80	91	94	85	89	78	83	78	96
7/26	91	90	80	92	94	87	90	80	85	81	97
7/27	92	91	81	93	95	88	92	82	87	82	98
7/28	94	93	82	94	95	90	94	84	89	83	98
7/29	94	94	85	94	97	92	95	86	90	86	99
7/30	95	95	88	96	97	93	96	89	91	89	99
7/31	96	96	91	96	98	93	97	91	93	90	99
8/1	96	97	93	97	98	94	97	92	94	92	99
8/2	97	97	94	97	99	95	98	94	95	94	99
8/3	98	98	95	98	99	95	98	95	96	93	99
8/4	98	98	96	98	99	96	99	96	96	96	100
8/5	98	99	97	99	99	96	99	97	97	97	100
8/6	98	99	98	99	99	97	99	98	98	97	100
8/7	99	99	99	99	99	97	99	98	98	98	100
8/8	99	100	99	99	99	97	100	98	98	99	100
8/9	99	100	99	99	100	98	100	99	99	99	100
8/10	99	100	99	99	100	98	100	99	99	99	100
8/11	99	100	99	100	99	100	99	99	99	99	100
8/12	99	100	100	100	100	99	100	99	99	99	100
8/13	100	100	100	100	100	99	100	99	100	100	100
8/14	100	100	100	100	100	99	100	99	100	100	100
8/15	100	100	100	100	100	100	100	100	100	100	100
8/16	100	100	100	100	100	100	100	100	100	100	100
8/17	100	100	100	100	100	100	100	100	100	100	100
8/18	100	100	100	100	100	100	100	100	100	100	100
8/19	100	100	100	100	100	100	100	100	100	100	100
8/20	100	100	100	100	100	100	100	100	100	100	100
8/21	100	100	100	100	100	100	100	100	100	100	100
8/22	100	100	100	100	100	100	100	100	100	100	100
8/23	100	100	100	100	100	100	100	100	100	100	100
8/24	100	100	100	100	100	100	100	100	100	100	100
8/25	100	100	100	100	100	100	100	100	100	100	100
8/26	100	100	100	100	100	100	100	100	100	100	100
8/27	100	100	100	100	100	100	100	100	100	100	100
8/28	100	100	100	100	100	100	100	100	100	100	100
8/29	100	100	100	100	100	100	100	100	100	100	100
8/30	100	100	100	100	100	100	100	100	100	100	100
8/31	100	100	100	100	100	100	100	100	100	100	100
9/1	100	100	100	100	100	100	100	100	100	100	100
9/5	100	100	100	100	100	100	100	100	100	100	100
9/6	100	100	100	100	100	100	100	100	100	100	100
9/7	100	100	100	100	100	100	100	100	100	100	100
9/8	100	100	100	100	100	100	100	100	100	100	100

Appendix C.4. Historical sockeye salmon passage at the Kogrukuk River weir.

Date	Daily Passage															
	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
6/15	c								c	0						
6/16	c								c	1						
6/17	c								c	0						
6/18	c								c	3						
6/19	c								c	2						
6/20	c								c	5						
6/21	c								c	2						
6/22	c								c	1						
6/23	c								c	3						
6/24	c								c	2						
6/25	c								c	5						
6/26	c								c	3						
6/27	c								c	5						
6/28	c	0							c	3						
6/29	1	c	0						c	10						
6/30	0	c	1						c	3						
7/1	1	c	11	0	0	974	91 b	7	c	8						
7/2	4	c	36	1	0	1252	129 b	14	c	85	2 b	4	c	12 b	81 c	
7/3	7	c	35	8	1	940	222 b	c	c	124	1 b	10	c	18 b	91 a	
7/4	2	c	72	19	0	624	540 b	c	c	57	8 b	32	c	46 b	99 c	
7/5	17	c	58	14	4	798	705 b	c	c	51	4 b	17	c	75	109 a	
7/6	27	c	66	9	9	841	974 b	17	c	281	9	12	c	150	171 a	
7/7	66	c	31	75	c	595	1252 b	11	c	178	19	18	c	233	73 c	
7/8	133	c	101	124	c	636	1500 b	24	c	214	50	46	c	476	96 c	
7/9	204	c	105	61	12	702	2025	223	c	159	76	73	c	503	151 c	
7/10	207	c	143	65	258	435	1750	67	c	24	91	180	c	419	402 c	
7/11	120	c	116	84	120	847	748	4	c	62	129	364	c	507	698 c	
7/12	138	c	55	184	c	492	830	c	c	295	221	206	c	363	444 c	
7/13	230	c	72	315	c	421	821	c	c	173	234	400	c	239	527 c	
7/14	112	0	126	269	c	384	575	c	c	539	145	506	c	273	206 e	
7/15	101	2	67	220	c	469	302	c	c	438	178	498	c	276	370 e	
7/16	143	6	63	239	c	595	686	c	c	219	208	314	c	171	323 e	
7/17	102	7	74	174	c	421	781	c	c	192	185	380	c	109	293 e	
7/18	147	18	48	146	c	430	371	c	c	84	173	175	c	83	210 e	
7/19	79	149	45	82	c	386	443	c	c	63	259	105 b	c	46	145 e	
7/20	52	198	51	90	c	386	630	c	c	121	176	105 b	c	37	144 e	
7/21	166	153	24	83	c	595	315	c	c	169	207	125 b	c	40	172 e	
7/22	95	135	49	48	c	526	140	c	c	188	127	97 b	c	29	134 e	
7/23	43	111	40	47	c	365	149	c	c	39	115	68 b	c	33	93 c	
7/24	33	150	41	75	c	345	187	c	c	83	227	83 b	c	28	113 c	
7/25	34	95	32	32 b	c	297	185	c	c	38	242	66 b	c	9	90 c	
7/26	5	61	15	18 b	c	257	141	c	c	60	160	44 b	c	9	61 c	
7/27	7	27	8	14 b	c	287	123	c	c	50	164	41 b	c	4	56 c	
7/28	9	c	15	32 b	c	242	89	c	c	57	194	49 b	c	10	67 e	
7/29	3	c	11	25 b	c	189	86	c	c	32	157	37 b	c	6	50 c	
7/30	8	c	8	23 b	c	141	77	c	c	18	131	31 b	c	9	43 c	
7/31	6	c	7	26 b	c	110	67	c	c	14	93	24 b	c	12	33 c	
8/1	2 b	c	2 b	8 b	c	40	56	c	c	32	108	22 b	c	8 b	30 c	
8/2	3 b	c	3 b	2 b	c	67	26	c	c	25	57	14 b	c	4 b	19 c	
8/3	3 b	c	3 b	3 b	c	65	29	c	c	23	43	12 b	c	1	16 c	
8/4	3 b	c	3 b	3 b	c	41	23	c	c	20	41	11 b	c	5	15 c	
8/5	1 b	c	1 b	3 b	c	18	17	c	c	8	27	6 b	c	3	8 c	
8/6	6 b	c	6 b	1 b	c	27	12	c	c	2	27	8 b	c	2	10 c	
8/7	3 b	c	3 b	6 b	c	13	8	c	c	3	11	8 b	c	1	7 c	
8/8	0 b	c	0 b	3 b	c	15	9	c	c	3	27	2 b	c	0	6 c	
8/9	1 b	c	1 b	0 b	c	23	6	c	c	3	8	3 b	c	1	4 c	
8/10	1 b	c	1 b	1 b	c	20	5	c	c	1	7	3 b	c	3	3 c	
8/11	0 b	c	0 b	1 b	c	8	5	c	c	6	1	3 b	c	1	2 c	
8/12	0 b	c	0 b	0 b	c	12	3	c	c	3	13	3 b	c	1	3 c	
8/13	0 b	c	0 b	0 b	c	10	0	c	c	0	2	2 b	c	1	1 c	
8/14	1 b	c	1 b	0 b	c	10	4	c	c	1	1	0 b	c	1	2 c	
8/15	0 b	c	0 b	1 b	c	5	4	c	c	1	1	0 b	c	0	1 c	
8/16	0 b	c	6	1	c	0	0	c	c	0	0 b	1	c	0	0 c	
8/17		c	7	9	c	0	0	c	c	0	0 b	2	c	0	0 c	
8/18		c	4	0	c	0	0	c	c	0	0 b	2	c	1 c	0 a	
8/19		c	2	0	c	1	0	c	c	0	0 b	1	c	0 c	0 a	
8/20		c	2	0	c	0	0	c	c	0	0 b	1	c	0 c	0 a	
8/21		c	0	0	c	1	0	c	c	0	0 b	1	c	0 c	0 a	
8/22		c	2	0	c	8	0	c	c	0	1	0	c	1 c	0 a	
8/23		c	0	0	c	0	0	c	c	0	2	1	c	0	0 a	
8/24		c	3	0	c	8	0	c	c	0	3	1	c	0	1 c	
Total	2326	1112	1670	2628	-404	18066	17297	375	4133	4359	4244	278	4397	5811	8406	16455
Obs.	2302	1112	1646	2432	404	17691	11729	375	4133	4344	3252	278	4233	2599	8382	13687
Est.	24	525	24	196	2796	375	5568	801	8	15	992	695	162	3212	24	2768
Subtotal	2326	1637	1670	2628	3200 f	18066	17297	1176 f	4133	4359	4244	973 f	4397	5811	8406	16455
% Obs.	99	68	99	93	13	98	68	32	100	77	29	96	45	100	83	

a = Daily passage was estimated due to the occurrence of a hole in the weir.

b = The weir was not operational; daily passage was estimated.

c = The weir was not operational; daily passage was not estimated.

d = Partial day count, passage was not estimated.

e = Estimates not differentiable from observations.

f = Estimates not represented in the raw data; not broken down by day.

Appendix C.4. (Page 2 of 6).

Date	Daily Passage										
	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
6/15											
6/16											
6/17											
6/18											
6/19											
6/20											
6/21	1 b			0 b		0 b		0 b			
6/22	2 b	1 b	1 b	1 b	0 b	0 b			1 b		
6/23	1 b	3 b	2 b	1 b	2 b	0 b	0 b		2 b		
6/24	3 b	11 b	5 b	4 b	6 b	0 b	0 b		4 b		
6/25	4 b	17 b	8 b	7 b	9 b	0 b	0 b		4 b		
6/26	5 b	18 b	9 b	7 b	10 b	0 b	0 b		10 b	3	
6/27	8 b	33 b	16 b	12 b	17 b	0 b	0 b		5 b	5	
6/28	13 b	49 b	22 b	17 b	24 b	0 b	0 b		10 b	1	
6/29	32 b	126 b	56 b	43 b	61 b	8	3 b		15 b	17	
6/30	46 b	177 b	81 b	63 b	10	85	111 b		23 b	6	
7/1	33 b	242 b	105 b	81 b	75	30	40 b		134 b	16	
7/2	88	410 b	7	147 b	257	104	146 b		91 b	77	
7/3	181	120	8	31	385	91	122 b		143 b	145	
7/4	131	498 b	10	236	243	319	428 b		199 b	235	
7/5	103	524 b	24	383	452	291	391 b	10	50	158	
7/6	77	648	52	537	536	537	238 b	1	14	130	422
7/7	133	1126	120	458	806	574	13	7	12	245	43
7/8	61	1371	140	430	646	577	535	6	17	487	491
7/9	145	2157	205	501	1105	549	757	14	41	603	51
7/10	125	2517	126	708	945	261	397	41	91	345	190
7/11	355	1899	795	806	954	330	666	45	169	634	421
7/12	266	1796	784	337	968	377	1461	92	217	748	275
7/13	225	1818	848	395	1539	428	2069	143	35	524	127
7/14	394	1502	848	212	1122	421	1396	144	22	846	205
7/15	416	1832	864	362	821	668	992	228	103	499	157
7/16	406	2028	770	621	458	826	1108	400	285	346	211
7/17	239	2040	685	694	368	443	589	318	150	231	222
7/18	466	1711	1123	369	299	955	138	236	169	145	167 a
7/19	418	832	432	494	385	851	405	348	90	235	67
7/20	272	945	422	263	209	876	462	352	94	317 b	49 a
7/21	245	779	458	493	370	611	469	338	223	320 b	49 a
7/22	158	220	352	472	268	566	441	345	218	165 b	31
7/23	318	286	286	258	233	274	244	248	147	152 b	17
7/24	261	202	306	216	251	511	164	440	113	140 b	59
7/25	242	191	256	232	308	152	449	354	22	96 b	33
7/26	152	214	184	137	67	129	334	157	78	126 b	24
7/27	245	230	177	258	117	193	452	308	103	103 b	9
7/28	236	182	459	92	99	161	424	148	63	77 b	13
7/29	282	162 b	665	103	236	182	258	148	45	99	6
7/30	212	142 b	690	151	244	127	228	232	34	92	6
7/31	149	87	552	56	81	89	189	162	80	61	6
8/1	100	51	427	42	71	89	130	165	27	73	0
8/2	152	29	226	70	61	62	99	95	32	52	1
8/3	62	19	235	54	51	54	96	77	25 b	37	1
8/4	19 b	16	36	38	32	37	77	75	21 b	32	1
8/5	11 b	16	23	19	38	38	74	68 b	18 b	23	1
8/6	13 b	20	24	9	47	41	19	19 b	14 b	18	1
8/7	14 b	24	75	8	31	16	25	28	11 b	9	2
8/8	3 b	17	62	17	23	26	18	22	1	16	3
8/9	5 b	14	30	10	9	15	23	14	10	3	2
8/10	6	2	32	7 b	31	14	17	13	9	8	4
8/11	4	2	23	4 b	6 b	20	16	7	10	4	0
8/12	7	6	13	6 b	9 b	32	6	5	7	11	3
8/13	6	4	3 b	4 b	14 b	6	3	6	7	0	
8/14	4	0	9	12 b	16	5 b	11	6	7	7	0
8/15	0	0	1	0 b	7	4	6	3	6	4	2
8/16	0	0	7	0	1	5	6	3	3	1	1
8/17	4	0	4	1	2	2	3	3	2	3	0
8/18	0	0	2	1	5	4	3	0	1	1	2
8/19	0	0	1	2	0	1	1	2	1	1 b	0
8/20	0	0	1	1	1	1	2	1	1	0 b	0
8/21	1	0	1	1	0	0	0	0	1	0	3
8/22	0	1	0	2	0	4	0	1	1	0	0
8/23	0	1	0	4	1	1	0	1	1	1	3
8/24	0	1	0	1	0	0	0	1	1	1	1
Total	7540	29358	14192	10996	15385	13078	16773	5864	2867	8773	4050
Obs.	7329	26943	13887	10581	15221	13059	5321	5777	2778	6634	3913
Est.	211	2415	305	415	164	19	11452	87	89	2139	137
Subtotal	7540	29358	14192	10996	15385	13078	16773	5864	2867	8773	4050
% Obs.	97	92	98	96	99	100	32	99	97	76	97

a = Daily passage was estimated due to the occurrence of a hole in the weir.

b = The weir was not operational; daily passage was estimated.

c = The weir was not operational; daily passage was not estimated.

d = Partial day count, passage was not estimated.

e = Estimates not differentiable from observations.

f = Estimates not represented in the raw data; not broken down by day.

Appendix C.4. (Page 3 of 6)

Date	Cumulative Passage														
	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
6/15															
6/16															
6/17															
6/18															
6/19															
6/20															
6/21															
6/22															
6/23															
6/24															
6/25															
6/26															
6/27															
6/28															
6/29	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
6/30	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
7/1	2	12	0	0	2816	246	13	41	31	74	135	35	381		
7/2	6	48	1	0	4068	375	22	126	2	35	85	216	112	610	
7/3	13	103	9	1	5008	597	27	250	3	45	104	307	267	868	
7/4	15	175	28	1	5632	1137	27	307	11	77	150	406	374	1148	
7/5	32	233	42	5	6430	1842	27	358	15	94	225	515	645	1282	
7/6	59	299	51	14	7271	2816	44	639	24	106	375	686	1105	1282	
7/7	125	330	126	14	7866	4068	55	817	43	124	658	759	1406	1388	
7/8	258	431	250	14	8502	5568	79	1031	93	170	1134	855	2040	1520	
7/9	462	536	311	26	9204	793	304	1190	169	243	1639	1096	2244	2277	
7/10	669	679	376	284	9639	9343	371	1214	260	423	2058	1408	3071	3036	
7/11	789	795	460	404	10286	10091	375	1276	389	787	2563	2106	3508	3408	
7/12	927	850	644	10778	19921	1571	610	993	2930	2550	4125	3997			
7/13	1157	922	959	11199	11742	1744	844	1393	3169	3077	4241	5033			
7/14	1269	0	1048	1223	11583	12317	2083	989	1893	3442	3283	4763	6620		
7/15	1370	2	1115	1448	12052	12619	2521	1167	2391	78	3718	3653	5500	6762	
7/16	1513	8	1178	1687	12647	13305	2740	1375	2705	249	3897	3976	5963	7540	
7/17	1615	15	1252	1861	13068	14086	2932	1560	3085	249	4006	4269	6372	8354	
7/18	1762	33	1300	2007	13498	14457	3016	1733	3260	249	4089	4479	6801	9282	
7/19	1841	182	1345	2089	13884	14900	3079	1992	3365	249	4135	4624	6891	10230	
7/20	1893	380	1396	2179	14270	15530	3200	2168	3470	249	4172	4768	7048	11159	
7/21	2059	533	1420	2262	14865	15845	3369	2375	3595	249	4212	4940	7231	11913	
7/22	2154	668	1469	2310	15391	15985	3557	2502	3692	249	4241	5074	7434	12672	
7/23	2197	779	1509	2357	15756	16134	3646	2617	3760	249	4274	5167	7561	13289	
7/24	2230	929	1550	2432	16101	16321	3729	2844	3843	249	4302	5280	7634	13891	
7/25	2264	1024	1582	2464	16398	16506	3767	3086	3909	249	4311	5370	7691	14477	
7/26	2269	1085	1597	2482	16655	16647	3827	3246	3953	249	4320	5431	7774	14972	
7/27	2276	1112	1605	2496	16942	16770	3877	3410	3994	249	4324	5487	7795	15394	
7/28	2285	1620	2528	17184	16859	3934	3604	4043	249	4334	5554	7868	15650		
7/29	2288	1631	2553	17373	16945	3966	3761	4080	249	4346	5604	7985	15831		
7/30	2296	1639	2576	17514	17022	3984	3892	4111	249	4349	5647	8066	15959		
7/31	2302	1646	2596	17624	17089	3998	3985	4135	249	4361	5680	8126	16095		
8/1	2304	1648	2604	17704	17145	4030	4093	4157	249	4369	5710	8185	16199		
8/2	2307	1651	2606	17771	17171	4055	4150	4171	249	4373	5729	8249	16282		
8/3	2310	1654	2609	17836	17200	4078	4193	4183	249	4374	5745	8294	16330		
8/4	2313	1657	2612	17877	17223	4098	4234	4194	249	4377	5760	8311	16366		
8/5	2314	1658	2613	17895	17240	4106	4261	4200	249	4380	5768	8339	16390		
8/6	2328	1664	2616	17922	17252	4108	4288	4208	249	4382	5778	8351	16404		
8/7	2323	1667	2622	17935	17260	4111	4299	4216	249	4383	5785	8365	16414		
8/8	2323	1667	2625	17950	17269	4114	4326	4218	249	4383	5791	8378	16417		
8/9	2324	1668	2625	17973	17275	4117	4334	4221	251	4384	5795	8383	16420		
8/10	2325	1669	2626	17993	17280	4118	4341	4224	256	4387	5798	8384	16424		
8/11	2325	1669	2627	18091	17285	4124	4342	4227	262	4388	5800	8388	16430		
8/12	2325	1669	2627	18091	17288	4127	4355	4230	262	4389	5803	8394	16439		
8/13	2325	1669	2627	18093	17288	4127	4357	4232	263	4390	5804	8398	16443		
8/14	2326	1670	2627	18093	17292	4128	4358	4232	265	4391	5806	8401	16443		
8/15	2326	1670	2628	18098	17296	4129	4359	4232	266	4391	5807	8403	16444		
8/16		2623		18044	17297	4129	4359	4232	267	4391	5807	8403	16445		
8/17		18051	17297	4129	4359	4232	270	4391	5807	8406	16446				
8/18		18052	17297	4129	4359	4232	272	4393	5808	8406	16450				
8/19		18054	17297	4130	4359	4232	273	4394	5808	8406	16450				
8/20		18056	17297	4130	4359	4232	274	4394	5808	8406	16451				
8/21		18056	17297	4131	4359	4233	275	4395	5808	8406	16451				
8/22		18058	17297	4131	4359	4235	275	4396	5809	8406	16451				
8/23		18058	17297	4131	4359	4237	276	4396	5810	8406	16451				
8/24		18061	17297	4131	4359	4240	277	4396	5811	8406	16452				
8/25		18061	17297	4132	4359	4240	277	4396	5806	8406	16452				
8/26		18062	17297	4133	4359	4241	278	4396	5806	8406	16454				
8/27		18063	17297	4133	4359	4243	278	4397	5806	8406	16454				
8/28		18064	17297	4133	4359	4244	278	4397	5806	8406	16454				
8/29		18066	17297	4133	4359	4244	278	4397	5806	8406	16455				
8/30		18066	17297	0	4133	4359	4244	278	4397	5806	8406	16455			
8/31		18066	17297	0	4133	4359	4244	278	4397	5806	8406	16455			
9/1		18066	17297	0	4133	4359	4244	278	4397	5806	8406	16455			
9/2		18066	17297	0	4133	4359	4244	278	4397	5806	8406	16455			
9/3		18066	17297	0	4133	4359	4244	278	4397	5806	8406	16455			
9/4		18066	17297	0	4133	4359	4244	278	4397	5806	8406	16455			
9/5		18066	17297	0	4133	4359	4244	278	4397	5806	8406	16455			

## Appendix C.4. (Page 4 of 6).

Date	Cumulative Passage										
	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
6/15						0	0				
6/16						0	0				
6/17						0	0				
6/18						0	0				
6/19						0	0				
6/20						0	0				
6/21		1	0			0	0				
6/22		3	1	1	1	0	0			1	
6/23	1	6	3	2	3	0	0			2	
6/24	4	17	8	6	9	0	0			7	
6/25	8	34	16	13	17	0	0			10	
6/26	13	52	25	20	27	0	0			20	3
6/27	21	85	41	32	44	0	0			25	3
6/28	34	134	63	49	68	0	8			35	6
6/29	66	260	119	92	129	8	11			50	26
6/30	112	437	209	155	139	91	122			73	32
7/1	145	679	305	236	214	121	162			207	48
7/2	233	1089	312	283	471	225	302			298	125
7/3	414	1209	320	414	836	316	424			441	270
7/4	545	1707	330	650	1099	635	833			640	505
7/5	650	2231	354	1033	1551	926	1243			690	663
7/6	727	2879	406	1570	2087	1463	1481	1		24	820
7/7	860	4005	526	2028	2897	1494	8	36		1065	1123
7/8	921	5376	666	2458	3539	2614	2029	14		1552	1619
7/9	1066	7533	871	2959	4644	3163	2786	28		2155	1676
7/10	1191	10050	997	3667	5589	3424	3183	69		2500	1860
7/11	1546	11949	1792	4473	6543	3754	3850	114		354	2281
7/12	1812	13745	2576	4810	7451	4131	5310	206		571	3882
7/13	2037	15563	3424	5205	8990	4559	7379	349		606	4406
7/14	2431	17065	4272	5417	10112	4980	8776	493		628	5252
7/15	2847	18887	5136	5779	10933	5648	9267	721		731	5751
7/16	3253	20915	5906	6400	11391	6474	10876	1121		1016	6097
7/17	3492	22955	6591	7094	11759	6917	11465	1439		1166	6328
7/18	3958	24666	7714	7463	12058	7872	11603	1675		1335	6473
7/19	4576	25498	8146	7957	12443	8723	12008	2023		1425	6708
7/20	4648	26443	8568	8220	12652	9599	12470	2375		1519	7025
7/21	4893	27222	9026	8713	13022	10210	12919	2713		1742	7346
7/22	5031	27442	9378	9185	13290	10776	13380	3058		1960	7511
7/23	5349	27728	9664	9443	13523	11850	13634	3306		2107	7663
7/24	5610	27930	9970	9659	13774	11561	13788	3746		2220	7803
7/25	5852	28121	10226	9891	14082	11713	14237	4109		2242	7900
7/26	6004	28335	10410	10028	14149	11842	14571	4257		2320	8026
7/27	6249	28565	10587	10286	14266	12035	15023	4565		2433	8129
7/28	6485	28747	11037	10378	14365	12196	15447	4713		2486	8205
7/29	6767	28909	11702	10481	14601	12378	15705	4861		2531	8304
7/30	6979	29051	12392	10632	14845	12505	15933	5093		2565	8396
7/31	7128	29138	12944	10688	14926	12594	16122	5255		2645	8457
8/1	7228	29189	13371	10730	14993	12683	16252	5420		2672	8530
8/2	7380	29218	13597	10800	15058	12745	16351	5515		2704	8582
8/3	7442	29237	13832	10834	15109	12799	16447	5592		2739	8619
8/4	7461	29253	13868	10892	15141	12835	16524	5667		2750	8651
8/5	7472	29269	13891	10911	15179	12874	16598	5735		2768	8674
8/6	7485	29289	13915	10920	15226	12915	16617	5754		2782	8692
8/7	7499	29313	13990	10928	15257	12933	16642	5782		2793	8701
8/8	7502	29336	14052	10945	15280	12957	16660	5804		2794	8717
8/9	7508	29344	14082	10955	15289	12972	16683	5818		2804	8720
8/10	7514	29346	14114	10962	15320	12986	16700	5831		2813	8728
8/11	7518	29348	14137	10966	15326	13006	16716	5838		2823	8732
8/12	7525	29354	14150	10972	15335	13038	16722	5843		2830	8743
8/13	7531	29358	14154	10975	15339	13052	16728	5846		2836	8750
8/14	7535	29358	14163	10987	15355	13057	16739	5852		2843	8757
8/15	7535	29358	14164	10987	15362	13061	16745	5855		2849	8761
8/16	7535	29358	14171	10987	15363	13066	16751	5858		2852	8762
8/17	7539	29358	14175	10988	15365	13068	16754	5861		2854	8765
8/18	7539	29358	14177	10989	15370	13072	16757	5861		2855	8766
8/19	7539	29358	14178	10991	15379	13073	16758	5863		2856	8767
8/20	7539	29358	14179	10992	15371	13074	16760	5864		2857	8768
8/21	7540	29358	14180	10993	15371	13074	16764	5864		2858	8768
8/22		29358	14181	10993	15373	13074	16764	5864		2859	8768
8/23		29358	14182	10993	15377	13075	16765	5864		2860	8769
8/24		29358	14183	10993	15378	13075	16765	5864		2861	8770
8/25		29358	14185	10993	15379	13075	16765	5864		2862	8772
8/26		29358	14186	10993	15381	13075	16767	5864		2862	8772
8/27		29358	14188	10993	15381	13076	16768	5864		2862	8773
8/28		29358	14188	10993	15381	13077	16769	5864		2862	8773
8/29		29358	14192	10996	15385	13078	16769	5864		2862	8773
8/30		29358	14192	10996	15385	13078	16769	5864		2867	8773
8/31		29358	14192	10996	15385	13078	16769	5864		2867	8773
9/1		29358	14192	10996	15385	13078	16770	5864		2867	8773
9/2		29358	14192	10996	15385	13078	16772	5864		2867	8773
9/3		29358	14192	10996	15385	13078	16772	5864		2867	8773
9/4		29358	14192	10996	15385	13078	16772	5864		2867	8773
9/5		29358		10996	15385	13078	16772	5864		2867	8773

Appendix C.4. (Page 5 of 6).

Date	Cumulative Percent Passage														
	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
6/15															
6/16															
6/17															
6/18															
6/19															
6/20															
6/21															
6/22															
6/23															
6/24															
6/25															
6/26															
6/27															
6/28															
6/29	0	0													
6/30	6	6													
7/1	0	1	0												
7/2	0	3	0												
7/3	1	6	0												
7/4	1	10	1												
7/5	1	14	2												
7/6	3	18	2												
7/7	5	20	5												
7/8	11	26	10												
7/9	29	32	12												
7/10	29	41	14												
7/11	34	48	18												
7/12	60	51	25												
7/13	50	55	36												
7/14	55	63	47												
7/15	59	67	55												
7/16	65	71	64												
7/17	69	73	71												
7/18	76	78	76												
7/19	79	81	79												
7/20	81	84	83												
7/21	89	85	86												
7/22	93	88	88												
7/23	94	90	90												
7/24	96	93	93												
7/25	97	95	94												
7/26	98	96	94												
7/27	98	96	95												
7/28	98	97	96												
7/29	98	98	97												
7/30	99	98	98												
7/31	99	99	99												
8/1	99	99	99												
8/2	99	99	99												
8/3	99	99	99												
8/4	99	99	99												
8/5	99	99	100												
8/6	100	100	100												
8/7	100	100	100												
8/8	100	100	100												
8/9	100	100	100												
8/10	100	100	100												
8/11	100	100	100												
8/12	100	100	100												
8/13	100	100	100												
8/14	100	100	100												
8/15	100	100	100												
8/16															
8/17															
8/18															
8/19															
8/20															
8/21															
8/22															
8/23															
8/24															
8/25															
8/26															
8/27															
8/28															
8/29															
8/30															
8/31															
9/1															
9/2															
9/3															
9/4															
9/5															

Appendix C.4. (Page 6 of 6).

Date	Cumulative Percent Passage										
	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
6/15							0	0			
6/16							0	0			
6/17							0	0			
6/18							0	0			
6/19							0	0			
6/20							0	0			
6/21	0			0			0	0			
6/22	0	0	0	0	0		0	0			0
6/23	0	0	0	0	0	0	0	0			0
6/24	0	0	0	0	0	0	0	0			0
6/25	0	0	0	0	0	0	0	0			0
6/26	0	0	0	0	0	0	0	0		0	0
6/27	0	0	0	0	0	0	0	0		0	0
6/28	0	0	0	0	0	0	0	0		0	0
6/29	1	1	1	1	1	1	0	0		1	1
6/30	1	1	1	1	1	1	1	1		1	1
7/1	2	2	2	2	1	1	1	1		2	1
7/2	3	4	2	3	3	2	2			3	3
7/3	5	4	2	4	6	2	3			5	7
7/4	7	6	2	6	7	5	5			7	12
7/5	9	8	2	9	10	7	7	0		8	16
7/6	10	10	3	14	14	11	9	0	1	9	27
7/7	11	14	4	18	19	16	9	0	1	12	28
7/8	12	18	5	22	23	20	12	0	2	18	40
7/9	14	26	6	27	30	24	17	0	3	25	41
7/10	16	34	7	33	36	26	19	1	6	28	46
7/11	21	41	13	41	43	29	23	2	12	36	56
7/12	24	47	18	44	48	32	32	4	20	44	63
7/13	27	53	24	47	58	35	44	6	21	50	66
7/14	32	58	30	49	66	38	52	8	22	60	71
7/15	38	64	36	53	71	43	58	12	25	66	75
7/16	43	71	42	58	74	50	65	19	35	69	80
7/17	46	78	46	65	76	53	68	25	41	72	86
7/18	52	84	54	68	78	60	69	29	47	74	90
7/19	58	87	57	72	81	67	72	34	50	76	92
7/20	62	90	60	75	82	73	74	41	53	80	93
7/21	65	93	64	79	85	78	77	46	61	84	94
7/22	67	91	66	84	86	82	80	52	68	86	95
7/23	71	94	68	86	88	84	81	56	73	87	95
7/24	74	95	70	88	90	88	82	64	77	89	97
7/25	78	96	72	90	92	90	85	70	76	85	93
7/26	80	97	73	91	92	91	87	73	81	91	98
7/27	83	97	75	94	93	92	90	78	85	93	98
7/28	86	98	78	94	93	93	92	80	87	94	99
7/29	90	98	82	95	95	95	94	83	88	95	99
7/30	93	99	87	97	96	96	95	87	89	96	99
7/31	95	99	91	97	97	96	96	90	92	96	99
8/1	96	99	94	98	97	97	97	92	93	97	99
8/2	98	100	96	98	98	97	97	94	94	98	99
8/3	99	100	97	99	98	98	98	95	95	98	99
8/4	99	100	98	99	98	98	99	97	96	99	99
8/5	99	100	98	99	99	98	99	98	97	99	99
8/6	99	100	98	99	99	99	99	98	97	99	99
8/7	99	100	99	99	99	99	99	99	97	99	99
8/8	100	100	99	100	99	99	99	99	97	99	99
8/9	100	100	99	100	99	99	99	99	98	99	99
8/10	100	100	99	100	99	100	99	98	99	99	100
8/11	100	100	100	100	99	100	100	160	98	100	100
8/12	100	100	100	100	100	100	100	100	99	100	100
8/13	100	100	100	100	100	100	100	100	99	100	100
8/14	100	100	100	100	100	100	100	100	99	100	100
8/15	100	100	100	100	100	100	100	100	99	100	100
8/16	100	100	100	100	100	100	100	100	99	100	100
8/17	100	100	100	100	100	100	100	100	100	100	100
8/18	100	100	100	100	100	100	100	100	100	100	100
8/19	100	100	100	100	100	100	100	100	100	100	100
8/20	100	100	100	100	100	100	100	100	100	100	100
8/21	100	100	100	100	100	100	100	100	100	100	100
8/22	100	100	100	100	100	100	100	100	100	100	100
8/23	100	100	100	100	100	100	100	100	100	100	100
8/24	100	100	100	100	100	100	100	100	100	100	100
8/25	100	100	100	100	100	100	100	100	100	100	100
8/26	100	100	100	100	100	100	100	100	100	100	100
8/27	100	100	100	100	100	100	100	100	100	100	100
8/28	100	100	100	100	100	100	100	100	100	100	100
8/29	100	100	100	100	100	100	100	100	100	100	100
8/30	100	100	100	100	100	100	100	100	100	100	100
8/31	100	100	100	100	100	100	100	100	100	100	100
9/1	100	100	100	100	100	100	100	100	100	100	100
9/2	100	100	100	100	100	100	100	100	100	100	100
9/3	100	100	100	100	100	100	100	100	100	100	100
9/4	100	100	100	100	100	100	100	100	100	100	100
9/5	100	100	100	100	100	100	100	100	100	100	100

Appendix C.5. Historical coho salmon passage at the Kogrukuk River weir.

Date	Daily Passage										
	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
7/20	0	0	0	0	0	0	0	1	c	0	0
7/21	0	0	0	0	0	0	0	0	c	0	0
7/22	0	0	0	0	0	0	0	0	c	0	0
7/23	0	0	0	0	0	0	0	0	c	0	0
7/24	0	0	0	1	0	0	0	1	c	0	0
7/25	0	0	0	4	0	0	0	0	c	0	0
7/26	0	0	0	2	0	0	0	0	c	0	0
7/27	0	0	0	1	0	0	0	0	c	0	0
7/28	0	0	0	1	0	0	0	0	c	0	0
7/29	0	0	0	4	0	0	0	0	c	0	0
7/30	0	0	0	2	0	1 b	0	0	c	0	0
7/31	0	0	0	3	0	0 b	0	0	c	0	0
8/01	0	0	0	11	6	1 b	0	0	c	0	0
8/02	0	5	0	14	4	0 b	0	0	c	1	0
8/03	0	6	0	19	7	2 b	1 b	0	c	2	1
8/04	2	15	0	32	7	5 b	0 b	0	c	1	1
8/05	5	17	0	18	14	3 b	1 b	0	c	7	9
8/06	5	16	0	53	8	8 b	0 b	4	c	8	3
8/07	2	42	2 b	99	18	18 b	2 b	6	c	7	5
8/08	10	36	5 b	44	49	29 b	5 b	11	c	9	2
8/09	26	55	5 b	119	13	35 b	3	15	c	9	1
8/10	20	42	6 b	52	94	39 b	8	25	c	12	5
8/11	22	106	15 b	222	59	61 b	18	38	c	42	13
8/12	62	91	17 b	115	118	86 b	29	80	c	87	34
8/13	62	58	18	224	68	140 b	35	86	c	26	25
8/14	133	78	38	147	82	243 b	39	46	c	59	15
8/15	154	195	56	179	84	199 b	61	25	c	30	8
8/16	141	56	18	144	224 b	298 b	86	105	c	16	52
8/17	109	511	26	86	147 b	412 b	140	157	c	232	185
8/18	110	465	46	1,258	179 b	286 b	243	258	c	72	201
8/19	296	371	24	995	144 b	318 b	199	202	c	13	163
8/20	314	283	11	537	86 b	527 b	298	290	c	13	106
8/21	187	409	3	321	500 b	629	412	352	c	43	74
8/22	185	142	67	1,412	450 b	767	286	383	c	57	49
8/23	197	228	152	1,730	300	1,476	318	323	611	141	111
8/24	255	647	100	1,190	321	1,887	527	389	661	155	16
8/25	416	868	35	2,031	231	1,364	658	258	c	97	435
8/26	318	804	6	2,036	200	1,223	776	898	c	408	128
8/27	369	946	27	731	473	1,091	762	378	c	62	118
8/28	267	820	270	584	890	1,255	814	618	c	10	34
8/29	144	632	49	370	817	823	1,151	553	c	19	24
8/30	302	1,488	28	688	494	656	1,141	770	c	11	5
8/31	322	1,680	161	907	859	614	1,824	494	c	21	11
9/01	296	1,537	580	613	1,380	420	1,008	330	c	23	4
9/02	328	1,905	27	821	1,271	529	1,773	369	c	69	259
9/03	296	1,980	469	713	566	634	1,160	238	c	47	947
9/04	612	1,285	363	853	557	339	2,950	237	c	128	463
9/05	535	1,781	100	787	631	323	1,053	171	c	390	312
9/06	655	5,013	556	742	530	234	962	170	c	181	359
9/07	506	3,219	205	343	853	453	556 b	153	c	5	470
9/08	521	2,165	111	1,107	818	445 b	205 b	445	c	18	472
9/09	567	1,460	151	1,081	589	179 b	111 b	179	c	205	473
9/10	335	1,226	858	47	339	434 b	151 b	434	c	379 b	544
9/11	283	921	360	830	155	966 b	858 b	966	c	210 b	241
9/12	246	722	15	363	308	436 b	360 b	436	c	179 b	137
9/13	239	748	175	224	233	257 b	15 b	257	c	206 b	67
9/14	194	508	887	357	239	152 b	196 b	152	c	405 b	221

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Appendix C.5. (Page 2 of 12).

Date	Daily Passage										
	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
9/15	157	424 b	134	37	241	112 b	61	112	c	208 b	226
9/16	168	405 b	151	175 b	140	121 b	123	121	c	71 b	115 b
9/17	132	269 b	424	887 b	113	186 b	75	186	c	128 b	208 b
9/18	149	189 b	405	134 b	84	405 b	151	405 b	c	378 b	615 b
9/19	118	125 b	269	151 b	138	269 b	253	269 b	c	91 b	148 b
9/20	138	257 b	189	424 b	90	189 b	110	189 b	c	100 b	163 b
9/21	103	114 b	125	138 b	60	125 b	125	c	191 b	310 b	
9/22	114	135 b	257	90 b	38	257 b	175	257 b	c	189 b	306 b
9/23	78	47 b	114	60 b	9	114 b		114 b	c	130 b	212 b
9/24	44	45 b	135	38 b	14 b	135 b	113 b	135 b	c	106 b	172 b
9/25	30	43 b	47	9 b	20 b	47 b	84 b	47 b	c	73 b	119 b
9/26	29	29 b	45	14 b	19 b	45 b	138 b	45 b	c	125 b	202 b
9/27	26	26 b	43	20 b	18 b	43 b	90 b	43 b	c	63 b	101 b
9/28	13	13 b	29 b	19 b	15 b	29 b	60 b	29 b	c	61 b	99 b
9/29	14	14 b	26 b	18 b	7 b	26 b	38 b	26 b	c	25 b	41 b
9/30	20	20 b	13 b	15 b		13 b	9 b	13 b	c	24 b	39 b
10/01	19	19 b	14 b	7 b		14 b	14 b	14 b	c	3 b	5 b
10/02	18	18 b	20 b	26 b		20 b	20 b	20 b	c	1 b	1 b
10/03	15	15 b	19 b	13 b		19 b	19 b	19 b	c	3 b	4 b
10/04	7	7 b	18 b	14 b		18 b	18 b	18 b	c	20 b	70 b
10/05	10		15 b	20 b		15 b	15 b	15 b	c	17 b	
10/06	5 b		7 b	19 b		7 b	7 b	7 b	c	10 b	
Total	11,455	37,796	8,538	27,595	16,441	22,506	22,821	13,512	1,272	6,132	9,964
Obs.	11,450	35,582	8,327	25,304	14,618	14,717	19,756	11,722	1,272	2,736	7,034
Est.	5	2,214	211	2,291	1,823	7,789	3,065	1,790	n.a.	3,396	2,930
Subtotal	11,455	37,796	8,538	27,595	16,441	22,506	22,821	13,512	1,272	6,132	9,964
% Obs.	100	94	98	92	89	65	87	87	n.a.	45	71

a = Daily passage was estimated due to the occurrence of a hole in the weir.

b = The weir was not operational; daily passage was estimated.

c = The weir was not operational; daily passage was not estimated

d = Partial day count, passage was not estimated.

e = Majority of the run estimated; weir not operational much of the season

## Appendix C.5. (Page 3 of 12).

Date	Daily Passage										
	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
7/20	0	1	0	3	1	0	0	0	0	0	1 a
7/21	0	1	0	0	2	0	0	0	0	0	1 a
7/22	0	1	0	1	3	0	0	0	0	0	1 a
7/23	0	0	0	1	0	0	0	0	0	0	0
7/24	0	2	0	1	2	0	0	1	0	0	5
7/25	1	2	0	2	6	0	0	0	3	0	8
7/26	0	2	0	1	3	0	2	0	2	0	2
7/27	0	2	0	0	3	0	2	0	3	0	5
7/28	0	1	12	2	15	0	0	0	1	0	3
7/29	2	0 b	22	0	25	2	0	0	1	0	0
7/30	0	0 b	29	1	83	0	1	1	4	0	0
7/31	6	4	23	0	26	1	2	0	10	2	0
8/01	1	10	51	1	54 b	4	2	0	1	2	0
8/02	9	5	30	1	82 b	5	3	0	9	9	3
8/03	4	13	50	2	110	3	10	0	33 b	5	6 a
8/04	3	15	59 b	2	41	4	7	0	32 b	12	6 a
8/05	15 b	22	68 b	1	36	23	14	0 b	51 b	4	6 a
8/06	14 b	31	77 b	0	215	22	6	0 b	65 b	20	8
8/07	6 b	49	86	1	151	47	7	1	79 b	7	6
8/08	29 b	106	123	2	140	11	5	1	94	32	20
8/09	149 b	133	103	7	245	26	17	1	192	16	12
8/10	70	159	108	68 b	606	65	6	6	325	9	8
8/11	226	113	162 b	74 b	613 b	89	27	4	233	44	5
8/12	233	266	215	141 b	901 b	57 b	17	4	650	190	50
8/13	334	439	209	194 b	869 b	73 b	35	11	872	104	59
8/14	200	c	296 b	162 b	1,025 b	21	127	5	967	242	31
8/15	362	c	439	221 b	1,123	64	91	24	803	237	56
8/16	198	c	416	241 b	1,384	123	244	62	345	767	89
8/17	232	c	581	80	1,473	84	225	49	99	386	73
8/18	52	c	837	327	1,107	93	54	15	559	815	48
8/19	335	c	761	521	1,035	117	24	6	1,151	576	17
8/20	373	c	829	669	2,142	238	128	238	1,099	312 b	125
8/21	c	c	597	855	2,510	449	747	69	1,243	623 b	743
8/22	c	c	469	818	2,547	428	298	188	1,143	1,067	825
8/23	c	c	439	931	2,665	479	260	191	1,051	557	958
8/24	c	c	841	902	2,418	425	940	175	1,065	1,006	814
8/25	c	c	2,096	1,002	2,727	611	470	171	592	714	1,080
8/26	c	c	2,943	1,116	2,346	585	1,331	77	408	631	243
8/27	c	c	2,713	1,198	1,953	401	438	261	1,881	906	301
8/28	c	c	1,887	1,962	2,430	350	481	103	2,673	718	341
8/29	c	c	1,007	1,263	1,375	300	590	206	3,066	1,441	308
8/30	c	42 b	396	1,785	2,056	707	903	265	2,564	769	602
8/31	c	388	842	1,166	2,098	908	1,441	208	1,416	867	1,350
9/01	c	551	1,947	1,104 b	2,004	564	1,405	349	1,105	629	1,005
9/02	c	632	1,400	1,102 b	1,948	251	1,574	482	864	783	509
9/03	c	735	1,155	749	1,492	431	1,395	501	727	322	351
9/04	c	286	643	903	990	69	1,982	876	426	452	500
9/05	c	348	630	630	890	540	1,189	1,001	552	401	860
9/06	c	78 b	425	586	907	234	642	424	1,296	106	747
9/07	c	c	384	895 b	1,035	722	242	530	796	200	595
9/08	c	c	527	904 b	775	597	483	529	602	573	373
9/09	c	c	436	977 b	517	415	424	406	445	288	147
9/10	c	c	356	699 b	460	342	767	413	280	364	154
9/11	c	c	-	251 b	345	195	722	258	458	84	93
9/12	c	c	-	783 b	230	102	553	346	270	172	233
9/13	c	c	-	526 b	128	80	427	225	190	177	208
9/14	c	c	-	364 b	116	62	270	609	102	137	97

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Date	Daily Passage										
	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
9/15	c	c		161 b	72	52	356	442	70	92	110
9/16	c	c	514 b	196 b		89	363	128	33	572	71
9/17	c	c	567 b	241 b		89	435	232	39	258	53
9/18	c	c	1,082 b	274 b		64 b	229	571 b	43	167	35
9/19	c	c	1,068 b	100 b		38	201	380 b	24	107	42
9/20	c	c	737 b	214 b		28	330 b	267 b	28	62	29
9/21	c	c	601 b	256 b		26	222 b	176 b		136	23
9/22	c	c	415 b	36 b		140 b	273 b	363 b		62	16
9/23	c	c	707 b	72 b		62 b	196 b	161 b		67	13
9/24	c	c	354 b	23 b		73 b	182 b	190 b		37	35
9/25	c	c	318 b	29 b		26 b	87 b	66 b		49	
9/26	c	c	143 b	2 b		24 b	114 b	63 b			
9/27	c	c	137 b	3 b		14 b	59 b	61 b			
9/28	c	c	19 b	6 b		24 b	46 b	41 b			
9/29	c	c	3 b	4 b		17 b	37 b	37 b			
9/30	c	c	13 b	4 b		6 b	32 b	18 b			
10/01	c	c	268 b	5 b		8 b	25 b	20 b			
10/02	c	c		9 b		11 b	36 b	28 b			
10/03	c	c		14 b		10 b	34 b	27 b			
10/04	c	c		14 b		9 b	38 b	25 b			
10/05	c	c				8 b	21 b	21 b			
10/06	c	c									
	2,854	4,437	34,695	27,861	50,555	12,237	24,348	12,609	33,135	19,387	14,516
	2,715	4,317	27,057	17,492	47,011	11,611	22,614	10,094	32,875	18,308	14,501
	23,342	16,200	7,638	10,369	3,544	626	1,734	2,515	260	1,079	13
	26,057 c	20,517 c	34,695	27,861	50,555	12,237	24,348	12,609	33,135	19,387	14,516
	10	21	78	63	93	95	93	80	99	94	100

a = Daily passage was estimated due to the occurrence of a hole in the weir.

b = The weir was not operational; daily passage was estimated.

c = The weir was not operational; daily passage was not estimated.

d = Partial day count; passage was not estimated.

e = Majority of the run estimated; weir not operational much of the season

## Appendix C.5. (Page 5 of 12).

Date	Cumulative Passage										
	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
7/20	0	0	0	0	0	0	0	1	0	0	a
7/21	0	0	0	0	0	0	0	1	0	0	0
7/22	0	0	0	0	0	0	0	1	0	0	0
7/23	0	0	0	0	0	0	0	1	0	0	0
7/24	0	0	0	1	0	0	0	2	0	0	0
7/25	0	0	0	5	0	0	0	2	0	0	0
7/26	0	0	0	7	0	0	0	2	0	0	0
7/27	0	0	0	8	0	0	0	2	0	0	0
7/28	0	0	0	9	0	0	0	2	0	0	0
7/29	0	0	0	13	0	0	0	2	0	0	0
7/30	0	0	0	15	0	1	0	2	0	0	0
7/31	0	0	0	18	0	1	0	2	0	0	0
8/01	0	0	0	29	6	2	0	2	0	0	0
8/02	0	5	0	43	10	2	0	2	1	0	0
8/03	0	11	0	62	17	4	1	2	3	1	1
8/04	2	26	0	94	24	9	1	2	4	2	2
8/05	7	43	0	112	38	12	2	2	11	11	11
8/06	12	59	0	165	46	20	2	6	19	14	14
8/07	14	101	2	264	64	38	4	12	26	19	19
8/08	24	137	7	308	113	67	9	23	35	21	21
8/09	50	192	12	427	126	102	12	38	44	22	22
8/10	70	234	18	479	220	141	20	63	56	27	27
8/11	92	340	33	701	279	202	38	101	98	40	40
8/12	154	431	50	816	397	288	67	181	185	74	74
8/13	216	489	68	1,040	465	428	102	267	211	99	99
8/14	349	567	103	1,187	547	671	141	313	270	114	114
8/15	503	762	159	1,366	631	870	202	338	300	122	122
8/16	644	818	177	1,510	855	1,168	288	443	316	174	174
8/17	753	1,329	203	1,596	1,002	1,580	428	600	548	359	359
8/18	863	1,794	249	2,854	1,181	1,866	671	858	620	560	560
8/19	1,159	2,165	273	3,849	1,325	2,184	870	1,060	633	723	723
8/20	1,473	2,448	284	4,386	1,411	2,711	1,168	1,350	646	829	829
8/21	1,660	2,857	287	4,707	1,911	3,340	1,580	1,702	689	903	903
8/22	1,845	2,999	354	6,119	2,361	4,107	1,866	2,085	746	952	952
8/23	2,042	3,227	506	7,849	2,661	5,583	2,184	2,408	611	887	1,063
8/24	2,297	3,874	606	9,039	2,982	7,470	2,711	2,797	1,272	1,042	1,079
8/25	2,713	4,742	641	11,070	3,213	8,834	3,369	3,055	1,139	1,514	1,514
8/26	3,031	5,546	647	13,106	3,413	10,057	4,145	3,953	1,547	1,642	1,642
8/27	3,400	6,492	674	13,837	3,886	11,148	4,907	4,331	1,609	1,760	1,760
8/28	3,667	7,312	944	14,421	4,776	12,403	5,721	4,949	1,619	1,794	1,794
8/29	3,811	7,944	993	14,791	5,593	13,226	6,872	5,502	1,638	1,818	1,818
8/30	4,113	9,432	1,021	15,479	6,087	13,882	8,013	6,272	1,649	1,823	1,823
8/31	4,435	11,112	1,182	16,386	6,946	14,496	9,837	6,766	1,670	1,834	1,834
9/01	4,731	12,649	1,762	16,999	8,326	14,916	10,845	7,096	1,693	1,838	1,838
9/02	5,059	14,554	1,789	17,820	9,597	15,445	12,618	7,465	1,762	2,097	2,097
9/03	5,355	16,534	2,258	18,533	10,163	16,079	13,778	7,703	1,809	3,044	3,044
9/04	5,967	17,819	2,621	19,386	10,720	16,418	16,728	7,940	1,937	3,507	3,507
9/05	6,502	19,600	2,721	20,173	11,351	16,741	17,781	8,111	2,327	3,819	3,819
9/06	7,157	24,613	3,277	20,915	11,881	16,975	18,743	8,281	2,508	4,178	4,178
9/07	7,663	27,832	3,482	21,258	12,734	17,428	19,299	8,434	2,513	4,648	4,648
9/08	8,184	29,997	3,593	22,365	13,552	17,873	19,504	8,879	2,531	5,120	5,120
9/09	8,751	31,457	3,744	23,446	14,141	18,052	19,615	9,058	2,736	5,593	5,593
9/10	9,086	32,683	4,602	23,493	14,480	18,486	19,766	9,492	3,115	6,137	6,137
9/11	9,369	33,608	4,962	24,323	14,635	19,452	20,624	10,458	3,325	6,379	6,379
9/12	9,615	34,326	4,977	24,686	14,943	19,888	20,984	10,894	3,504	6,516	6,516
9/13	9,854	35,074	5,152	24,910	15,176	20,145	20,999	11,152	3,710	6,583	6,583
9/14	10,048	35,582	6,039	25,267	15,433	20,297	21,195	11,303	4,115	6,808	6,808

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Appendix C.5. (Page 6 of 12).

Date	Cumulative Passage										
	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
9/15	10,205	36,006	6,173	25,304	15,676	20,409	21,256	11,415	4,323	7,034	
9/16	10,373	36,411	6,324	25,479	15,816	20,530	21,379	11,536	4,394	7,149	
9/17	10,505	36,680	6,748	26,366	15,929	20,716	21,454	11,722	4,522	7,357	
9/18	10,654	36,869	7,153	26,500	16,013	21,121	21,605	12,127	4,900	7,972	
9/19	10,772	36,994	7,422	26,651	16,151	21,390	21,858	12,396	4,991	8,120	
9/20	10,910	37,251	7,611	27,075	16,241	21,579	21,968	12,585	5,091	8,283	
9/21	11,013	37,365	7,736	27,213	16,301	21,704	22,021	12,710	5,282	8,593	
9/22	11,127	37,500	7,993	27,303	16,339	21,961	22,196	12,967	5,471	8,899	
9/23	11,205	37,547	8,107	27,363	16,348	22,075	22,196	13,081	5,601	9,111	
9/24	11,249	37,592	8,242	27,401	16,362	22,210	22,309	13,216	5,707	9,283	
9/25	11,279	37,635	8,289	27,410	16,382	22,257	22,393	13,263	5,780	9,402	
9/26	11,308	37,664	8,334	27,424	16,401	22,302	22,531	13,308	5,905	9,604	
9/27	11,334	37,690	8,377	27,444	16,419	22,345	22,621	13,351	5,968	9,705	
9/28	11,347	37,703	8,406	27,463	16,434	22,374	22,681	13,380	6,029	9,804	
9/29	11,361	37,717	8,432	27,481	16,441	22,400	22,719	13,406	6,054	9,845	
9/30	11,381	37,737	8,445	27,496		22,413	22,728	13,419	6,078	9,884	
10/01	11,400	37,756	8,459	27,503		22,427	22,742	13,433	6,081	9,889	
10/02	11,418	37,774	8,479	27,529		22,447	22,762	13,453	6,082	9,890	
10/03	11,433	37,789	8,498	27,542		22,466	22,781	13,472	6,085	9,894	
10/04	11,440	37,796	8,516	27,556		22,484	22,799	13,490	6,105	9,964	
10/05	11,450		8,531	27,576		22,499	22,814	13,505	6,122		
10/06	11,455		8,538	27,595		22,506	22,821	13,512	6,132		

## Appendix C.5. (Page 7 of 12).

Date	Cumulative Passage										
	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
7/20	0	1	0	3	1	0	0	0	0	0	1
7/21	0	2	0	3	3	0	0	0	0	0	1
7/22	0	3	0	4	6	0	0	0	0	0	2
7/23	0	3	0	5	6	0	0	0	0	0	2
7/24	0	5	0	6	8	0	0	1	0	0	7
7/25	1	7	0	8	14	0	0	1	3	0	15
7/26	1	9	0	9	17	0	2	1	5	0	17
7/27	1	11	0	9	20	0	4	1	8	0	22
7/28	1	12	12	11	35	0	4	1	9	0	25
7/29	3	12	34	11	60	2	4	1	10	0	25
7/30	3	12	63	12	143	2	5	2	14	0	25
7/31	9	16	86	12	169	3	7	2	24	2	25
8/01	10	26	137	13	223	7	9	2	25	4	25
8/02	19	31	167	14	305	12	12	2	34	13	28
8/03	23	44	217	16	415	15	22	2	67	18	34
8/04	26	59	276	18	456	19	29	2	99	30	39
8/05	41	81	344	19	492	42	43	2	150	34	45
8/06	55	112	421	19	707	64	49	2	215	54	53
8/07	61	161	507	20	858	111	56	3	294	61	59
8/08	90	267	630	22	998	122	61	4	388	93	79
8/09	239	400	733	29	1,243	148	78	5	580	109	91
8/10	309	559	841	97	1,849	213	84	11	905	118	99
8/11	535	672	1,003	171	2,462	302	111	15	1,138	162	104
8/12	768	938	1,218	312	3,363	359	128	19	1,788	352	154
8/13	1,102	1,377	1,427	506	4,232	432	163	30	2,660	456	213
8/14	1,302	1,377	1,723	668	5,257	453	290	35	3,627	698	244
8/15	1,664	1,377	2,162	889	6,380	517	381	59	4,430	935	300
8/16	1,862	1,377	2,578	1,130	7,764	640	625	121	4,775	1,702	389
8/17	2,094	1,377	3,159	1,210	9,237	724	850	170	4,874	2,088	462
8/18	2,146	1,377	3,996	1,537	10,344	817	904	185	5,433	2,903	510
8/19	2,481	1,377	4,757	2,058	11,379	934	928	191	6,584	3,479	527
8/20	2,854	1,377	5,586	2,727	13,521	1,172	1,056	429	7,683	3,791	652
8/21	1,377	6,183	3,582	16,031	1,621	1,803	498	8,926	4,414	1,395	
8/22	1,377	6,652	4,400	18,578	2,049	2,101	686	10,069	5,481	2,220	
8/23	1,377	7,091	5,331	21,243	2,528	2,361	877	11,120	6,038	3,178	
8/24	1,377	7,932	6,233	23,661	2,953	3,301	1,052	12,185	7,044	3,992	
8/25	1,377	10,028	7,235	26,388	3,564	3,771	1,223	12,777	7,758	5,072	
8/26	1,377	12,971	8,351	28,734	4,149	5,102	1,300	13,185	8,389	5,315	
8/27	1,377	15,684	9,549	30,687	4,550	5,540	1,561	15,066	9,295	5,616	
8/28	1,377	17,571	11,511	33,117	4,900	6,021	1,664	17,739	10,013	5,957	
8/29	1,377	18,578	12,774	34,492	5,200	6,611	1,870	20,805	11,454	6,265	
8/30	1,419	18,974	14,559	36,548	5,907	7,514	2,135	23,369	12,223	6,867	
8/31	1,807	19,816	15,725	38,646	6,815	8,955	2,343	24,785	13,090	8,217	
9/01	2,358	21,763	16,829	40,650	7,379	10,360	2,692	25,890	13,719	9,222	
9/02	2,990	23,163	17,931	42,598	7,630	11,934	3,174	26,754	14,502	9,731	
9/03	3,725	24,318	18,680	44,090	8,061	13,329	3,675	27,481	14,824	10,082	
9/04	4,011	24,961	19,583	45,080	8,130	15,311	4,551	27,907	15,276	10,582	
9/05	4,359	25,591	20,213	45,970	8,670	16,500	5,552	28,459	15,677	11,442	
9/06	4,437	26,016	20,799	46,877	8,904	17,142	5,976	29,755	15,783	12,189	
9/07		26,400	21,694	47,912	9,626	17,384	6,506	30,551	15,983	12,784	
9/08		26,927	22,598	48,687	10,223	17,867	7,035	31,153	16,556	13,157	
9/09		27,363	23,575	49,204	10,638	18,291	7,441	31,598	16,844	13,304	
9/10		27,719	24,274	49,664	10,980	19,058	7,854	31,878	17,208	13,458	
9/11		27,719	24,525	50,393	11,175	19,788	8,351	31,536	17,391	13,551	
9/12		27,719	25,308	50,239	11,277	20,333	8,458	32,606	17,464	13,784	
9/13		27,719	25,834	50,367	11,357	20,760	8,683	32,796	17,641	13,992	
9/14		27,719	26,198	50,483	11,419	21,030	9,292	32,898	17,778	14,089	

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Appendix C.5. (Page 8 of 12).

Date	Cumulative Passage										
	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
9/15			27,719	26,359	50,555	11,471	21,386	9,734	32,968	17,870	14,199
9/16			28,233	26,555		11,560	21,749	9,862	33,001	18,442	14,270
9/17			28,800	26,796		11,649	22,184	10,094	33,040	18,700	14,323
9/18			29,882	27,070		11,713	22,413	10,665	33,083	18,867	14,358
9/19			30,950	27,170		11,751	22,614	11,045	33,107	18,974	14,400
9/20			31,687	27,384		11,779	22,944	11,312	33,135	19,036	14,429
9/21			32,288	27,640		11,805	23,167	11,488		19,172	14,452
9/22			32,703	27,676		11,945	23,440	11,850		19,234	14,468
9/23			33,410	27,748		12,007	23,636	12,011		19,301	14,481
9/24			33,764	27,771		12,080	23,818	12,202		19,338	14,516
9/25			34,112	27,800		12,106	23,905	12,268		19,387	
9/26			34,255	27,802		12,130	24,019	12,332			
9/27			34,392	27,805		12,144	24,078	12,392			
9/28			34,411	27,811		12,168	24,124	12,433			
9/29			34,414	27,815		12,185	24,161	12,470			
9/30			34,427	27,819		12,191	24,193	12,488			
10/01			34,695	27,824		12,199	24,218	12,508			
10/02				27,833		12,210	24,254	12,536			
10/03				27,847		12,220	24,288	12,563			
10/04				27,861		12,229	24,326	12,588			
10/05						12,237	24,348	12,609			
10/06											

Appendix C.5. (Page 9 of 12).

Date	Cumulative Percent Passage										
	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
7/20	0	0	0	0	0	0	0	0	0	0	0
7/21	0	0	0	0	0	0	0	0	0	0	0
7/22	0	0	0	0	0	0	0	0	0	0	0
7/23	0	0	0	0	0	0	0	0	0	0	0
7/24	0	0	0	0	0	0	0	0	0	0	0
7/25	0	0	0	0	0	0	0	0	0	0	0
7/26	0	0	0	0	0	0	0	0	0	0	0
7/27	0	0	0	0	0	0	0	0	0	0	0
7/28	0	0	0	0	0	0	0	0	0	0	0
7/29	0	0	0	0	0	0	0	0	0	0	0
7/30	0	0	0	0	0	0	0	0	0	0	0
7/31	0	0	0	0	0	0	0	0	0	0	0
8/01	0	0	0	0	0	0	0	0	0	0	0
8/02	0	0	0	0	0	0	0	0	0	0	0
8/03	0	0	0	0	0	0	0	0	0	0	0
8/04	0	0	0	0	0	0	0	0	0	0	0
8/05	0	0	0	0	0	0	0	0	0	0	0
8/06	0	0	0	1	0	0	0	0	0	0	0
8/07	0	0	0	1	0	0	0	0	0	0	0
8/08	0	0	0	1	1	0	0	0	1	0	0
8/09	0	1	0	2	1	0	0	0	1	0	0
8/10	1	1	0	2	1	1	0	0	1	0	0
8/11	1	1	0	3	2	1	0	1	2	0	0
8/12	1	1	1	3	2	1	0	1	3	1	1
8/13	2	1	1	4	3	2	0	2	3	1	1
8/14	3	2	1	4	3	3	1	2	4	1	1
8/15	4	2	2	5	4	4	1	3	5	1	1
8/16	6	2	2	5	5	5	1	3	5	2	2
8/17	7	4	2	6	6	7	2	4	9	4	4
8/18	8	5	3	10	7	8	3	6	10	6	6
8/19	10	6	3	14	8	10	4	8	10	7	7
8/20	13	6	3	16	9	12	5	10	11	8	8
8/21	14	8	3	17	12	15	7	13	11	9	9
8/22	16	8	4	22	14	18	8	15	12	10	10
8/23	18	9	6	28	16	25	10	18	14	11	11
8/24	20	10	7	33	18	33	12	21	17	11	11
8/25	24	13	8	40	20	39	15	23	19	15	15
8/26	26	15	8	47	21	45	18	29	25	16	16
8/27	30	17	8	50	24	30	22	32	26	18	18
8/28	32	19	11	52	29	55	25	37	26	18	18
8/29	33	21	12	54	34	59	30	41	27	18	18
8/30	36	25	12	56	37	62	35	46	27	18	18
8/31	39	29	14	59	42	64	43	50	27	18	18
9/01	41	33	21	62	51	66	48	53	28	18	18
9/02	44	39	21	65	58	69	55	55	29	21	21
9/03	47	44	26	67	62	71	60	57	30	31	31
9/04	52	47	31	70	65	73	73	59	32	35	35
9/05	57	52	32	73	69	74	78	60	38	38	38
9/06	62	65	38	76	72	75	82	61	41	42	42
9/07	67	74	41	77	77	85	62	41	41	47	47
9/08	71	79	42	81	82	79	85	66	41	51	51
9/09	76	83	44	85	86	80	86	67	45	56	56
9/10	79	86	54	85	88	82	87	70	51	62	62
9/11	82	89	58	88	89	86	90	77	54	64	64
9/12	84	91	58	89	91	88	92	81	57	65	65
9/13	86	93	60	90	92	90	92	83	61	66	66
9/14	88	94	71	92	94	90	93	84	67	68	68

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Appendix C.5. (Page 10 of 12).

Date	Cumulative Percent Passage										
	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
9/15	89	95	72	92	95	91	93	84		70	71
9/16	91	96	74	92	96	91	94	85		72	72
9/17	92	97	79	96	97	92	94	87		74	74
9/18	93	98	84	96	97	94	95	90		80	80
9/19	94	98	87	97	98	95	96	92		81	81
9/20	95	99	89	98	99	96	96	93		83	83
9/21	96	99	91	99	99	96	96	94		86	86
9/22	97	99	94	99	99	98	97	96		89	89
9/23	98	99	95	99	99	98	97	97		91	91
9/24	98	99	97	99	100	99	98	98		93	93
9/25	98	100	97	99	100	99	98	98		94	94
9/26	99	100	98	99	100	99	99	98		96	96
9/27	99	100	98	99	100	99	99	99		97	97
9/28	99	100	98	100	100	99	99	99		98	98
9/29	99	100	99	100	100	100	100	99		99	99
9/30	99	100	99	100		100	100	99		99	99
10/01	100	100	99	100		100	100	99		99	99
10/02	100	100	99	100		100	100	100		99	99
10/03	100	100	100	100		100	100	100		99	99
10/04	100	100	100	100		100	100	100		100	100
10/05	100		100	100		100	100	100		100	
10/06	100		100	100		100	100	100		100	

## Appendix C.5. (Page 11 of 12).

Date	Cumulative Percent Passage										
	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
7/20			0	0	0	0	0	0	0	0	0
7/21			0	0	0	0	0	0	0	0	0
7/22			0	0	0	0	0	0	0	0	0
7/23			0	0	0	0	0	0	0	0	0
7/24			0	0	0	0	0	0	0	0	0
7/25			0	0	0	0	0	0	0	0	0
7/26			0	0	0	0	0	0	0	0	0
7/27			0	0	0	0	0	0	0	0	0
7/28			0	0	0	0	0	0	0	0	0
7/29			0	0	0	0	0	0	0	0	0
7/30			0	0	0	0	0	0	0	0	0
7/31			0	0	0	0	0	0	0	0	0
8/01			0	0	0	0	0	0	0	0	0
8/02			0	0	1	0	0	0	0	0	0
8/03			1	0	1	0	0	0	0	0	0
8/04			1	0	1	0	0	0	0	0	0
8/05			1	0	1	0	0	0	0	0	0
8/06			1	0	1	1	0	0	1	0	0
8/07			1	0	2	1	0	0	1	0	0
8/08			2	0	2	1	0	0	1	0	1
8/09			2	0	2	1	0	0	2	1	1
8/10			2	0	4	2	0	0	3	1	1
8/11			3	1	5	2	0	0	3	1	1
8/12			4	1	7	3	1	0	5	2	1
8/13			4	2	8	4	1	0	8	2	1
8/14			5	2	10	4	1	0	11	4	2
8/15			6	3	13	4	2	0	13	5	2
8/16			7	4	15	5	3	1	14	9	3
8/17			9	4	18	6	3	1	15	11	3
8/18			12	6	20	7	4	1	16	15	4
8/19			14	7	23	8	4	2	20	18	4
8/20			16	10	27	10	4	3	23	20	4
8/21			18	13	32	13	7	4	27	23	10
8/22			19	16	37	17	9	5	30	28	15
8/23			20	19	42	21	10	7	34	31	22
8/24			23	22	47	24	14	8	37	36	27
8/25			29	26	52	29	15	10	39	40	35
8/26			37	30	57	34	21	10	40	43	37
8/27			45	34	61	37	23	12	45	48	39
8/28			51	41	66	40	25	13	54	52	41
8/29			54	46	68	42	27	15	63	59	43
8/30			55	52	72	48	31	17	71	63	47
8/31			57	56	76	56	37	19	75	68	57
9/01			63	60	80	60	43	21	78	71	64
9/02			67	64	84	62	49	25	81	75	67
9/03			70	67	87	66	55	29	83	76	69
9/04			72	70	89	66	63	36	84	79	73
9/05			74	73	91	71	68	44	86	81	79
9/06			75	75	93	73	70	47	90	81	84
9/07			76	78	95	79	71	52	92	82	88
9/08			78	81	96	84	73	56	94	85	91
9/09			79	85	97	87	75	59	95	87	92
9/10			80	87	98	90	78	62	96	89	93
9/11			80	88	99	91	81	64	98	99	95
9/12			80	91	99	92	84	67	98	90	95
9/13			80	93	100	93	85	69	99	91	96
9/14			80	94	100	93	86	74	99	92	97

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Date	Cumulative Percent Passage										
	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
9/15		80	95	100	94	88	77	99	92	98	
9/16		81	95		94	89	78	100	95	98	
9/17		83	96		95	91	80	100	96	99	
9/18		86	97		96	92	85	100	97	99	
9/19		89	98		96	93	88	100	98	99	
9/20		91	98		96	94	90	100	98	99	
9/21		93	99		96	95	91		99	100	
9/22		94	99		98	96	94		99	100	
9/23		96	100		98	97	95		100	100	
9/24		97	100		99	98	97		100	100	
9/25		98	100		99	98	97		100		
9/26		99	100		99	99	98				
9/27		99	100		99	99	98				
9/28		99	100		99	99	99				
9/29		99	100		100	99	99				
9/30		99	100		100	99	99				
10/01		100	100		100	99	99				
10/02			100		100	100	99				
10/03			100		100	100	100				
10/04			100		100	100	100				
10/05					100	100	100				
10/06											